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ABSTRACT

Two standing committees of the Advisory Council on College Chemistry, the Teacher Development Committee and the Two-Year College Committee, jointly sponsored a 2-part study of the chemistry programs and faculty of 2-year colleges during 1966-1967. Preliminary results of the study were reported and discussed at a conference held in Dallas, Texas, in January 1968. The purposes of the study and conference were to: (1) bring into focus the current needs of the 2-year college chemistry faculties and to devise or recommend programs to satisfy these needs; and (2) set in motion plans for new training programs to develop an adequate number of qualified chemistry teachers with an understanding of, and commitment to, the philosophy and program of the 2-year colleges. This report presented the findings of the study, certain recommendations based on the study and on the ideas presented by the participants at the conference, and condensations of the principal papers presented at the conference. (MB)

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# A Report on THE EDUCATION AND TRAINING OF CHEMISTRY TEACHERS FOR TWO-YEAR COLLEGES

W. T. Mooney, Jr.

and

R. C. Brasted

Based on a *Survey of Two-Year Colleges and College Teachers* undertaken for the Advisory Council on College Chemistry by W. T. Mooney, Jr.

and

*A Conference on the Development of Teachers for Two-Year College Chemistry Programs* chaired by R. C. Brasted, Chairman of the $AC_3$ Committee on Teacher Training, and W. T. Mooney, Jr., Chairman of the $AC_3$ Committee on Chemistry in Two-Year Colleges.

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Advisory Council on College Chemistry
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# *Advisory Council on College Chemistry*

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The Advisory Council on College Chemistry, an independent group of chemists, has as its goal the improvement of undergraduate chemistry curricula and instruction. The Council collects and disseminates information through the activities of standing committees on Freshman Chemistry, Curriculum and Advanced Courses, Teaching Aids, Teacher Development, Science for Non-Science Majors, Two-Year College, and Resource Papers. Additional *ad hoc* groups act as necessary to further assist the Council in providing leadership and stimulus for imaginative projects on the part of individual chemists.

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# INTRODUCTION

## The Development of Teachers for Two-Year College Chemistry Programs

There is general concern in the chemical community for the development of an adequate number of well qualified chemistry teachers for our institutions of higher education. Two $AC_3$ standing committees, the Teacher Development Committee and the Two-Year College Committee, joined together to develop for themselves, for the Advisory Council, and for the chemical community, profiles of contemporary two-year college chemistry teachers and programs so that problems in the development of teachers for two-year colleges could be better understood.

The two committees jointly sponsored a two-part study of the chemistry programs and faculty of the two-year colleges during 1966-1967. The first results of this study were reported and discussed at a conference in Dallas, Texas on January 25-27, 1968.

The study and conference were designed to:

(1) bring into focus the current needs of the two-year college chemistry faculties and to devise or recommend programs to satisfy these needs;

(2) set into motion plans for new educational and training programs, or curricula, and methods to develop enough qualified chemistry teachers to meet the demand for chemistry teachers with an understanding of and commitment to the philosophy and program of the two-year colleges.

This publication contains:

- A report of the findings of the study and certain recommendations, based on this study and on the ideas presented by the participants at the conference, as developed by the co-chairmen of the conference, W. T. Mooney, Jr. and R. C. Brasted.

- Condensations of the principal papers presented at the Conference.

The analysis of the statistical data and the comments and recommendations that are presented along with the data have not been submitted to the conference participants, and it does not, therefore, necessarily reflect the views of the participants. While it is based on the conference proceedings, it does not carry the formal approval of the conference participants or of the Advisory Council.

Considered were the needs of the contemporary faculty of these colleges and the requirements of such institutions for new teaching personnel for their chemistry transfer, occupational, general education, and remedial programs. It is recognized that many organizations, institutions, and persons share the responsibility for the development and improvement of chemistry faculty for the two-year colleges. The paragraphs which follow the presentation of data from the study indicate how those concerned with this project view these groups and their responsibilities.

We report here an analysis of data obtained by responses to two questionnaires.

One was sent to the administrators of chemistry departments in 780 two-year colleges. Some of the 507 replies received indicated either that chemistry was not offered or that the institution belonged more nearly to a four-year college classification. Useful, pertinent information was obtained from 453 replies. The questionnaire dealt mainly with curriculum, enrollment, numbers and duties of faculty, etc. Opportunity also was given for open-ended response to the question of what programs the $AC_3$ might undertake to improve the teaching of chemistry in two-year colleges.

The second questionnaire was sent to individual faculty members teaching chemistry in two-year colleges. It was very difficult to establish a comprehensive list of chemistry faculty; even the American Association of Junior Colleges could supply only a two year old list, admittedly only 80% complete. However, this list was supplemented with names of individuals obtained

from the first questionnaire to department administrators. In all, 649 useful replies were received from this faculty questionnaire. It is impossible to estimate what fraction of the total number of faculty is represented by the return. It does appear to be a representative sample. The information that was requested dealt with training, experience, teaching loads, etc. An opportunity was offered for the expression of opinions on kinds of refresher courses desired, or other means of keeping up to date and increasing teacher effectiveness.

The data will be presented here in summary tables only. Notations to the tables will call attention to the most pertinent data. Recommendations based upon these data and implications follow the appropriate tables and notes.

## I. CHEMISTRY ENROLLMENT AND FACULTY

**TABLE 1**

**Chemistry Enrollment and Faculty, Two-Year Colleges 1966 - 1967**

| | 1967 Junior College Directory | Returns from $AC_3$ Study |
|---|---|---|
| Number of Colleges | 837 | 453 |
| Total Enrollment In These Colleges[1] | 1,464,099 | 1,022,000 |
| Chemistry Enrollment in These Colleges | 106,147[2] | 74,355 |
| Chemistry Faculty in These Colleges | .....[3] | 1,377 |

(1) These October 1, 1966 enrollment figures as reported in the 1967 **Junior College Directory** show that the 453 respondent colleges included approximately 70 percent of all the two-year college students.

(2) An estimate based on 74,355 being 7.25% of the total enrollment reported for the 453 responding schools.

(3) No information available upon which an estimate could be based.

These data and those in Table 2 show the magnitude of the problem and the study. Any recommendations related to Tables 1 and 2 are found in connection with the more specific aspects of the problem following later tables.

## II. ASSIGNMENTS OF CHEMISTRY FACULTY

**TABLE 2**

**Assignments of Chemistry Faculty, Two-Year Colleges 1966 - 1967**

| | Number of Faculty | Percentage |
|---|---|---|
| Number of persons teaching chemistry in 453 colleges, 1966-67 | | |
| Full-time employees of the college | 1,142 | 83% |
| Part-time employees of the college | 235 | 17% |
| Assignments of full-time employees teaching chemistry | | |
| Chemistry teaching only | 589 | 52% |
| Chemistry teaching & administrative and/or counselling duties | 324 | 29% |
| Chemistry teaching & teaching of courses other than chemistry | 280 | 25% |
| | | (1) |
| Assignments to Specialized Chemistry Courses | | |
| Organic chemistry | 328 | 24% |
| Analytical chemistry[3] | 251 | 18% |
| Chemistry for nurses and paramedical programs | 128 | 9% |
| Chemical technology & chemistry for technicians[4] | 77 | 6% |
| | | (2) |

(1) The total exceeds 100% because of some overlapping in the second and third categories.

(2) These figures imply that less than one quarter of the faculty are assigned to any one specialty area and that most faculty teach some form of introductory chemistry.

(3) The assignment to analytical chemistry is probably high since some colleges not reporting enrollment in analytical chemistry courses reported teachers assigned to teach analytical chemistry. Presumably these colleges include qualitative analysis or utilize quantitative techniques in their freshman course and interpreted an assignment to a particular general chemistry term as being to analytical chemistry.

(4) The data for paramedical and technician course assignments are probably high, since some colleges enrolling chemical and other technicians in their general chemistry courses and nursing and paramedical students in chemistry for the non-science majors courses reported teachers being assigned to teach such courses but did not report enrollment for them.

## III. COURSE ASSIGNMENTS OF CHEMISTRY FACULTY

**TABLE 3**

**Course Assignments of 649 Chemistry Faculty in Two-Year Colleges 1966 - 1967**

| Course Type | Percent of Faculty(1) Assigned to this Course in Present College 1966-67 | Taught this Course in Present College 1960-66 |
|---|---|---|
| General Chemistry(2) | 80 | 66 |
| Chemistry for Non-Science Majors | 42 | 40 |
| Beginning Chemistry(3) | 27 | 25 |
| Organic Chemistry | 34 | 30 |
| Analytical Chemistry | 24 | 25 |
| Physical Chemistry | 1 | 1 |
| Chemical Technology | 5 | 5 |
| Chemistry for Nurses | 15 | 15 |
| Special Problems | 4 | 2 |
| Physical Science | 12 | 13 |
| Physics | 7 | 16 |
| Mathematics(4) | 14 | 14 |
| Biological Sciences | 4 | 6 |
| Geological Sciences | 2 | 2 |
| Engineering Courses | 3 | 3 |
| Other | 5 | 5 |

(1) The figures given are the percentage, in each course type, of the total 649 responders. Obviously, few faculty teach only one type of course.

(2) General chemistry is the only course which shows a big increase for 1966-67 over the previous 6-year period. This course is the one most often taken by the transfer student. This indicates again that the greatest use of 2-year faculty is in this course.

(3) "Beginning chemistry," as used here, means a course of high school equivalent level.

(4) Note that additional teaching assignments in mathematics, physics and physical science involve a considerable number of chemistry faculty.

### *Recommendations Stemming from Course Assignment Data*

Table 3 shows that a very high percentage of the chemistry faculty are assigned to general chemistry and other introductory chemistry courses. In addition, a substantial number are involved in teaching physical science, physics, or mathematics. Recommendations following from this are:

(1) *Graduate schools* must recognize the need for a broadly based master's degree (see Table 5) in chemistry for teaching in the two-year college. There is also the need for some interdisciplinary education and training programs combining chemistry, physics, mathematics, and other physical sciences.

(2) *Two-year college administrators* must recruit faculty having a broad background in chemistry with a minimum of a master's in the field. Present faculty should be encouraged to obtain such a background. Rotation of teaching assignments of properly prepared chemistry faculty among the various chemistry courses will lessen the enervating effect of continually teaching the same subject at the same level. Rotation will also promote the flow of new ideas into courses.

Present figures clearly show that a disturbingly small fraction of the students proceed from the introductory course to a second year offering such as organic or quantitative analysis. Effective rotation by the faculty, then, depends upon student interest in chemistry being stimulated to the point where students will wish to proceed to courses beyond the introductory level.

(3) *Groups such as the AC's, NSF, etc.*, concerned with the stimulation and improvement of chemistry faculty should develop programs, institutes, and conferences that are devoted to improving the teacher's command of basic principles of chemistry, rather than narrow specialty areas. These programs should also improve his ability to communicate these basic principles to his students, utilizing modern teaching methods and resources. New techniques and programs are needed to maintain faculty interest in subject matter and classroom presentations over a many-year span.

## IV. ADDITIONS AND REPLACEMENTS TO CHEMISTRY FACULTY

**TABLE 4**

**Additions and Replacements to Chemistry Faculty in 453 Two-Year Colleges 1966 - 1967 and 1967 - 1968**

| | 1966-67 Number of Positions | 1967-68 Number of Positions |
|---|---|---|
| Number of new chemistry faculty positions (for enrollment growth, program expansion, opening of new colleges, etc.) authorized | 200 | 155(2) |
| Number of replacement chemistry faculty positions (because of resignations, retirements, reassignments, leaves, etc.) for which persons were sought | 109 | 128 |
| Total(1) number of new appointments needed | 309 | 283 |
| Number of positions unfilled in 1966-1967 and not filled by June 1, 1967 for 1967-1968 | 34 | 86 |

(1) The number of new positions filled in 1966-1967 (309-34=275) represents 20% of the total chemistry faculty (1377) reported for that year in table 1.

(2) The study does not reflect the new chemistry teaching positions in colleges opening initially in 1967 whereas it does include those colleges which opened initially in 1966. Thus, the 155 new positions for 1967-1968 is a smaller percentage of the total number of new positions among all two-year colleges for that year than the 200 is for the previous year.

### *Recommendations Stemming from Data on Chemistry Faculty Additions and Replacements*

These data, combined with those from Tables 5, 8, 11, 14 and 16, considered in the light of the rapid expansion of present campuses and the appearance of new campuses at a rate in excess of one per week, suggest that the number of chemistry positions to be filled each year will increase for several years. It also suggests an increasing number of authorized positions will be left unfilled or will be filled with persons possessing substandard academic and experience qualifications. In view of this:

(1) *Graduate schools* must recognize the need to develop and publicize programs in chemistry designed to prepare teachers for two-year colleges. Greater efforts must also be made to identify potential college chemistry teachers among undergraduate chemistry students.

(2) *Two-year colleges* must strengthen their recruitment programs for obtaining qualified personnel and realize that failure to fill authorized positions means that (a) class sizes are increased, (b) students are turned away, or (c) present heavy teaching loads are increased. Filling positions with substandard personnel can reduce the quality of the educational program. The ACS and AAJC can help in this by devising a cooperative public relations and recruitment program to publicize the advantages of teaching chemistry in two-year colleges. Creative means of using qualified chemistry faculty more efficiently, without sacrifice in the quality of student learning, must be developed and evaluated.

(3) *The ACS and AAJC* could profitably undertake a study of the potential use of chemical technology degree graduates with industrial experience as faculty for such programs. In this connection, a comparison should be made of the recruitment practices and difficulties found in filling faculty positions in chemical technology and other similar fields such as electronics technology.

### *Recommendations Stemming from Minimum Requirements for Employment (See Table 5, p. 5)*

It is evident that the two-year colleges consider a strong, broadly-based, subject matter master's degree in chemistry as the minimum requirement for chemistry teaching. As a consequence:

(1) *Graduate programs in chemistry* have an obligation to serve the need for two-year college teachers by providing such a master's degree in chemistry. Furthermore, this degree should be research-oriented. The program should be designed so that a student can eventually continue on to a doctor's degree in chemistry. Universities should adopt new policies and practices for doctor's programs in chemistry which would effectively encourage qualified faculty to obtain the degree. A study of pres-

## V. MINIMUM REQUIREMENTS FOR EMPLOYMENT AS A MEMBER OF CHEMISTRY FACULTIES

**TABLE 5**
**Minimum Requirements for Employment as a Member of the Chemistry Faculty, Two-Year Colleges,[1] 1966 - 1967 and 1967 - 1968**

| Description of Requirement | Percent of 370 Colleges Listing This Requirement As: Required | Desirable | Neither Required Nor Desirable | Not Indicated |
|---|---|---|---|---|
| Master's degree (any field) | 33 | 8 | 15 | 45 |
| Master's degree (chemistry)[2] | 55 | 40 | 1 | 5 |
| Doctor's degree (any field) | — | 18 | 27 | 55 |
| Doctor's degree (chemistry)[3] | 1 | 44 | 19 | 36 |
| State credential or certificate to teach | 31 | 9 | 31 | 29 |
| Other credential or certificate to teach[5] | 2 | 4 | 44 | 50 |
| Completion of education courses | 10 | 20 | 30 | 40 |
| Two-Year college teaching experience[4] | 4 | 60 | 12 | 24 |
| Four-Year college teaching experience[4] | 2 | 42 | 21 | 36 |
| High school teaching experience[4] | 2 | 39 | 21 | 38 |
| Other requirements[5] | 11 | 6 | 5 | 80 |

(1) A total of 370 responses to this section of the questionnaire were obtained. Most of these represent institutions which were seeking to fill openings on their staff. Some colleges listed more than one opening and indicated different requirements for the various positions.

(2) Note that more than half the colleges require this degree in chemistry; nearly all (95%) consider it required or desirable.

(3) Note that though few require the Ph.D. in chemistry, nearly half the colleges at least consider it desirable.

(4) Note that 63% of the colleges want faculty with experience in two-year colleges; 44% view 4-year college experience as valuable; nearly the same number (42%) feel high school teaching experience to be valuable.

(5) Credentials other than state (6% required or desirable) and other requirements (16% required or desirable) play a minor role on a national basis although they may be extremely important at the local level.

ent obstacles and hardships in these programs is needed.

Teaching experience and education courses are indicated as desirable, even if not required. Master's programs should, therefore, provide some teaching experience, preferably through cooperative internship programs. Special chemistry teaching-oriented seminars devoted to teaching aids and methods, psychology of learning, evaluation of learning and teaching, data processing, etc., should also be included.

Universities must recognize the effort put forth by their faculty who function as mentors for interns or trainees just as they do for graduate and post-graduate students. Present teaching assistantship programs are badly in need of revision and improvement to make them more relevant to later teaching experience.

Incorporation of the above features of internships, seminars, etc., into the normal work for the master's degree could form the basis of a two- or three-year experimental master's program at some graduate schools. The graduates of such programs may be especially capable in teaching at two-year colleges and should be suitably recognized by their employers as having more preparation than a regular master's degree in chemistry.

(2) *Two-year colleges* must develop practices and policies which effectively encourage qualified faculty to continue their education to the highest possible level. They must offer salaries to chemistry teachers competitive with those which could be received in other fields requiring the same education.

In staffing the chemical technology and other occupationally oriented curricula, the two-year college must study the possibility of using industrial chemists who have been

provided with appropriate additional education experience. This experience may differ from the traditional patterns of vocational technical teacher education. Conversely, the college can benefit from cooperative training programs with chemically-related industries for faculty who do not have the appropriate industrial experience, but who must be assigned to occupationally oriented courses. It is apparent that the school must recognize that the selection criteria may reasonably differ from those used, for instance, in other segments of the chemistry offerings.

(3) *Foundations and granting agencies* should develop realistic programs to encourage and provide for qualified chemistry faculty to continue their education to the highest possible level.

(4) *Professional subject matter groups*, such as those found within the American Chemical Society, could offer their assistance to credential granting agencies in helping to determine requirements for two-year college teaching. Cooperatively, such groups should see that credential requirements and master's degree requirements are coordinated as much as possible.

## VI. ENROLLMENT IN CHEMISTRY COURSES

**TABLE 6**
**Enrollment in Chemistry Courses, Two Year Colleges, 1966 - 1967**

| Type of Course | Number of Students Enrolled (Number of Courses Reported) | | | |
|---|---|---|---|---|
| | Fall Semester or Fall Quarter | Spring Semester or Winter Quarter | Spring Quarter | Enrollment by Courses |
| General Chemistry(1) | 39,009 | 30,486 | 4,407 | 73,992 |
| | (422) | (413) | (97) | |
| Chemistry for Non-Science Majors(2) | 12,533 | 10,578 | 1,724 | 25,855 |
| | (197) | (192) | (41) | |
| Beginning Chemistry (High School Equivalent)(2) | 9,353 | 5,960 | 517 | 15,830 |
| | (105) | (86) | (17) | |
| Chemistry for Nurses(2) | 5,148 | 3,128 | 490 | 8,766 |
| | (84) | (63) | (12) | |
| Organic Chemistry(3) | 3,373 | 3,497 | 657 | 7,527 |
| | (201) | (242) | (51) | |
| Analytical Chemistry(3) | 1,121 | 1,578 | 559 | 4,058 |
| | (123) | (120) | (30) | |
| Chemical Technology(4) | 1,193 | 1,175 | 300 | 2,668 |
| | (44) | (46) | (15) | |
| Other Courses(5) | 715 | 606 | 54 | 1,375 |
| | (21) | (29) | (3) | |
| Total Enrollment by Terms | 74,355 | 57,008 | 8,708 | 140,071 |

(1) About 53% of the students were in this course. Since most colleges reported more than one type of introductory course, the majority of enrollees here intended a science or engineering major.

(2) Courses for non-science majors, high-school equivalence and nurses enroll about 37%. These three represent a category distributed differently in various institutions. They have in common fewer prerequisites and demand less sophistication in mathematics.

(3) Note that only about 7% of the students were enrolled in typically second year courses (organic or analytical). However the fraction of students taking these courses in the later terms increased slightly.

(4) This figure is probably low since some colleges with separate general chemistry, organic chemistry, and analytical chemistry courses for chemical technology students appeared to have reported these under the general, organic, and analytical course categories rather than under this separate category.

(5) Among the other courses, which accounted for less than 1% of the total chemistry enrollment, were physical chemistry, chemistry for other specialized occupations and special projects.

*Recommendations Stemming from Enrollment in Chemistry Course Information*

Nine of every ten students were enrolled in general chemistry or a course requiring less chemical and mathematical sophistication. University teacher preparation programs must concentrate on developing teachers competent in both the chemical concepts and techniques for these courses and in the communication and teaching of these concepts and techniques at this level to typical two-year college students. Although these programs will have to prepare some persons for the more specialized courses, the demand for such specialized preparation will not be nearly as great as that for general chemistry and the less sophisticated courses.

## VII. ADMINISTRATION OF CHEMISTRY DEPARTMENTS

**TABLE 7**
**Administration of Chemistry Departments, Two-Year Colleges, 1966 - 67**

| | Number of Colleges |
|---|---|
| A. Subject Field of the Administrator | |
| Chemistry | 356 |
| Other Field | 96 |
| Not Determinable | 1 |
| Total | 453 |
| B. Other Science Faculties Administered by Administrator of the Chemistry Department | |
| Biological Science | 173 |
| Chemical Technology | 38 |
| Engineering | 60 |
| Engineering Technology | 24 |
| Geological Science | 111 |
| Mathematics | 134 |
| Physical Science Survey | 184 |
| Physics | 217 |

*Recommendations Stemming from Administration of Chemistry Departments*

The administration of chemistry departments is frequently (23%) in the hands of a non-chemist. To help these persons understand chemistry programs and their problems and needs, the $AC_3$, the Division of Chemical Education, and the Education Office of ACS could assist by organizing regional conferences dealing with the administrative and logistic problems of two-year college chemistry programs.

Since the administrator of the chemistry department frequently administers the programs of other disciplines, similar cooperative intercommission programs might be organized among the $AC_3$, CCP, CUEBS, CEGS, and CUPM.

## VIII. AGE DISTRIBUTION OF CHEMISTRY FACULTY

**TABLE 8**
**Age Distribution of 649 Chemistry Faculty Two-Year Colleges, 1966 - 1967**

| Age | Number of Faculty | Percentage of Faculty |
|---|---|---|
| 21 - 25 | 23 | 4 |
| 26 - 30 | 103 | 16 |
| 31 - 35 | 115 | 18 |
| 36 - 40 | 109 | 17 |
| 41 - 45 | 81 | 13 |
| 46 - 50 | 68 | 10 |
| 51 - 55 | 52 | 8 |
| 56 - 60 | 47 | 7 |
| 61 - 65 | 24 | 4 |
| over 65 | 10 | 2 |
| not given | 17 | 3 |

*Recommendations Stemming from Age Distribution of Chemistry Faculty*

(1) The majority of the faculty are between the ages of 30 and 50. They are therefore some years out of graduate school but have many years of teaching activity remaining. To prevent obsolescence, programs and institutes similar to those in recommendation 3. Table 3, must be designed to update the chemical knowledge and teaching methods of these faculty.

(2) Additional recommendations related to the age of faculty are found after Table 12.

## IX. NUMBER OF YEARS IN PRESENT POSITIONS FOR CHEMISTRY FACULTY

**TABLE 9**
**Number of Years Service in Present Position for 649 Chemistry Faculty in Two-Year Colleges, 1966 - 1967**

| Number of Years Service | % of Faculty | Number of Years Service | % of Faculty |
|---|---|---|---|
| | | 1 year | 17 |
| | | 2 years | 17(1) |
| 1 - 10 | 79 | 3 years | 12 |
| | | 4 years | 7 |
| | | 5 years | 9(2) |
| | | 6-10 years | 17 |
| 11 - 20 | 13(3) | | |
| 21 - 30 | 4 | | |
| 31 or more | 1 | | |

(1) Over 34% entered two-year college teaching in the past two years.
(2) Approximately 62% have been in their present positions for five years or less.
(3) Less than 20% have had 10 or more years of experience in their present positions.

*Recommendations Stemming from Number of Years in Present Positions for Chemistry Faculty*

(1) *Graduate schools and chemistry departments* of universities, state two-year college coordinating agencies, and foundations supporting programs for teacher improvement must realize that, with a large number of faculty with only a few years of experience in two-year college teaching, seminars and summer programs on the teaching of chemistry in the two-year colleges could be presented with a large potential payoff in terms of instructional improvement.

(2) *The AC$_3$, ACS, and AAJC* must realize that the large number of two-year college chemistry faculty with relatively few years of experience suggests that studies of the problems and needs of teachers in their first few years of teaching in the two-year college might be particularly helpful for the planning of assistance programs. Such studies should be concerned with (a) chemistry knowledge and understanding, (b) ability to communicate chemistry to two-year college students, (c) knowledge of and orientation to the community college, and (d) understanding of and ability to work with community college students.

(3) Additional recommendations stemming from the years of service in present positions are found after Table 12.

## X. DISTRIBUTION OF HIGHEST DEGREES HELD BY CHEMISTRY FACULTY

**TABLE 10**
**Distribution of Highest Degrees Held by 649 Chemistry Faculty Two-Year Colleges, 1966 - 1967**

| Highest Degree Held | Percentage of Faculty |
|---|---|
| Bachelor's | 8 |
| Master's | 76 |
| Doctor's | 17 |

| Highest Degree In Chemistry(1) | Percentage of Faculty |
|---|---|
| None | 23(2) |
| Bachelor's | 18(2) |
| Master's | 46 |
| Doctor's | 13 |

(1) A faculty member may have a Bachelor's degree in chemistry and a Master's in a different field. He would be included in the Bachelor percentage here, but in the Master percentage above.
(2) Note that 41% of the teachers hold no degree in chemistry beyond the Bachelor's.

*Recommendations Stemming from Distribution of Highest Degrees Held by Chemistry Faculty*

(1) The groups listed in recommendation (1) under Table 9 must realize that some in-service, or other training programs, must be presented which are based on the bachelor's level in chemistry. Other programs to bring faculty up to that level are also required. These programs must have heavy components of both chemistry and the development of ability to communicate.

(2) Earlier recommendations following Table 5, which gives data on minimum requirements for two-year college teaching positions also find much support from these data.

(3) Additional recommendations stemming from the highest degree data are found after Table 12.

## XI. DISTRIBUTION OF HIGHEST DEGREES HELD BY CHEMISTRY FACULTY

**TABLE 11**
**Degree Majors of 649 Chemistry Faculty Two-Year Colleges, 1966 - 1967**

| Major Field of Degree | Percentage of reported degrees in particular subject area | | |
|---|---|---|---|
| | Bachelor's | Master's | Doctor's |
| Chemistry or Biochemistry | 64 | 57(1) | 81(2) |
| Chemical Engineering | 5 | 2 | — |
| Other physical, engineering and math sciences | 6 | 4 | 10 |
| Biology | 6 | 4 | 1 |
| Chemical Education or Science Teaching | 3 | 10 | —(3) |
| General, Physical or Natural Science | 7 | 7 | 7 |
| Education | 2 | 12 | — |
| Other and not stated | 8 | 1 | 1 |

(1) The master's degree in chemistry and biochemistry was held by 53% of the 649 respondents.

(2) The doctor's degree in chemistry or biochemistry was held by 13% of the 649 respondents.

(3) None of the 649 respondents hold this degree despite the not uncommon suggestion that the Ed.D. with a science concentration or science major is appropriate for the two-year college teacher.

*Recommendations Stemming from the Distribution of Highest Degrees Held by Chemistry Faculty*

(1) The master's degree in chemistry is, according to Table 5, considered to be the minimum requirement for two-year college chemistry faculty. Table 11 shows only a slight majority have this degree. *Graduate schools must,* therefore, design master's degree programs for two-year college faculty who wish to acquire this degree. The same applies to Ph.D. programs. These programs should be relevant to lower division and occupational level chemistry teaching. They must be geographically accessible, economically feasible, and intellectually stimulating.

(2) *The two-year colleges* must encourage (perhaps require) and support programs to help their faculty get the master's degree. This encouragement must include leave and financial considerations. The colleges must realize that the maintenance of quality in their program demands this, and that such action is as much their responsibility as it is that of the individual to obtain this advanced work, especially when it will require considerable sacrifice on the part of the person.

(3) Additional recommendations stemming from degree major data are found after Table 12.

## XII. DATES OF CHEMISTRY FACULTY DEGREES

**TABLE 12**
**Dates of Degrees in Chemistry Earned by 649 Chemistry Faculty of Two-Year Colleges, 1966 - 1967**

| Year of Degree | Percent Earning Degrees | | |
|---|---|---|---|
| | Bachelor's | Master's | Doctor's |
| 1900 - 1929 | 6 | 3 | 1 |
| 1930 - 1944 | 27 | 14 | 23 |
| 1945 - 1954 | 26 | 22 | 20 |
| 1955 - 1959 | 19 | 12 | 16 |
| 1960 - 1965 | 21 | 35 | 30 |
| 1966 - 1967 | 1 | 14 | 10 |
| Not stated | — | 1 | — |

*Recommendations Stemming from the Dates of Degrees in Chemistry Earned by the Chemistry Faculty*

A majority of the degrees in each category were obtained before 1960. This suggests the need for special programs, not necessarily degree oriented, to update the chemistry of the two-year college teacher. Before this is done, however, a summary of post-degree education of these faculty members should be made. This information is needed to estimate the effectiveness of present summer institutes, programs, etc.

*Recommendations Stemming from Data in Tables 8-12 Considered Collectively*

(1) *Graduate schools* should be encouraged to consider the awarding of certificates or diplomas to recognize work through all the Ph.D. requirements except the research and thesis. In turn, two-year college administrators and boards must provide suitable recognition for those with such certification.

The $AC_3$, ACS, and AAJC could provide avenues for developing a procedure for this certification and recognition.

University chemistry departments and graduate schools must provide some financial aid for the advanced training of two-year college chemistry teachers as graduate teachers, interns, or visiting staff in return for the use of the experience of such teachers for assistance in teaching and improving their undergraduate courses.

(2) *Granting agencies and foundations* should review and revise their guidelines, evaluation procedures, and funding for special summer and academic year programs (institutes, conferences, research participation, fellowships, etc.) as a consequence of these data and other reports of the expressed needs of the two-year college faculty. Certain needs are different enough from those of four-year college teachers to justify different programs for the two-year colleges. Increases in the number of programs available, the number of positions within existing programs, and the funds available to participants for expenses and stipends are needed.

Increased university chemistry department interest in hosting such programs is needed. Such programs will also improve university/two-year college articulation and student recruitment. They could also improve the quality of chemistry instruction in both types of institutions.

(3) Case studies of recent or current programs that have been of value to the two-year college chemistry faculty should be prepared and published, perhaps by $AC_3$, to provide guidelines for other institutions. Examples of such programs are: the Oregon State University summer institute and graduate program, the University of Pacific doctoral program, the Louisiana State University sequential summer and year doctoral program, and the Wayne State University academic year in-service program.

Case studies of the graduates of such programs would be helpful in determining the value of the program to the graduates' teaching duties. Graduates of these programs should be asked to suggest modifications and improvements.

## XIII. DISTRIBUTION OF TYPES OF COLLEGES AWARDING DEGREES TO CHEMISTRY FACULTY

**TABLE 13**
**Distribution of Types of Colleges Awarding Degrees to 649 Chemistry Faculty in Two-Year Colleges, 1966 - 1967**

| Total Number of Degrees[1] | Bachelor's 649[2] | Master's 600 | Doctor's 107 |
|---|---|---|---|
| Type of Institution | Percent of Degrees Earned | | |
| State University[3] | 31 | 48 | 61 |
| State College | 21 | 15 | 2 |
| Private University | 14 | 24 | 27 |
| Liberal Arts College | 23 | 5 | — |
| Technical University | 4 | 4 | 7 |
| Service Academy | 1 | — | — |
| Foreign Institution | 1 | 1 | 1 |
| Teachers College (private) | 1 | 1 | — |
| Municipal College or University | 2 | 1 | 2 |
| Other | — | 1 | — |
| Not Stated | 1 | 1 | 1 |

| Attended a Two-Year College as a Student[4] | |
|---|---|
| Yes | 22 |
| No | 78 |

(1) These numbers correlate with the distributions indicated in Table 10.

(2) Note that three types of institution (state universities, state colleges and liberal arts colleges) trained 75% of the teachers at the bachelor's level. The distribution among these is almost equal.

(3) Note that state universities contribute most to the advanced training of two-year college faculty (48% at the master's and 61% at the doctor's level).

(4) The relatively large group of teachers who were not at one time students in a two-year college suggests that there are many persons entering two-year college chemistry teaching somewhat unfamiliar with the programs and problems of such colleges and with their unique community relationship.

### *Recommendations Stemming from the Distribution of Types of Colleges Awarding Degrees to Chemistry Faculty*

(1) *The chemistry faculties* of state universities must develop a greater awareness of their role in providing advanced training for two-year college teachers. Liberal arts college

chemistry faculties must become more aware of the inclinations their graduates may have toward teaching careers in the two-year colleges.

(2) *Teacher development programs* for two-year college chemistry teachers must recognize that few potential two-year college teachers have had student experience in such an institution.

(3) Additional recommendations stemming from the distribution of types of colleges awarding degrees to chemistry faculty are found after Table 18.

## XIV. PREPARATION FOR TEACHING OF TWO-YEAR COLLEGE FACULTY

**TABLE 14**
**Preparation for Teaching of 649 Two-Year College Faculty, 1966 - 1967**

| | Percentage[1] |
|---|---|
| A. Experience as a Teaching Assistant | |
| Undergraduate and graduate | 16 |
| Graduate only | 31 |
| Undergraduate only | 10 |
| None | 44 |
| B. Completed a Course or Seminar Dealing with Two-Year College teaching | |
| Yes[2] | 20 |
| No | 78 |
| C. Completed Practice Teaching Prior to Teaching in Two-Year College | |
| Yes[3] | 54 |
| No | 45 |

(1) The total percentages in categories B and C fall short of 100 due to a few "no response" returns.
(2) Half of those completing such a course indicated that they did so as a requirement for a teaching position.
(3) Only 8% of those who answered yes indicated that their practice teaching was at the two-year college level.

### *Recommendations Stemming from the Preparation for Teaching of the Chemistry Faculty*

(1) The suitability and actual and potential contribution of the teaching assistanship to the preparation and improvement of two-year college teachers must be studied. Ways to identify and involve potential two-year college chemistry teachers in pre-employment teaching experiences particularly appropriate to the two-year college should be sought. Practice teaching and internship programs in two-year colleges have already been suggested.

(2) Additional ways need to be developed to introduce seminars or courses devoted to the teaching of college chemistry into graduate chemistry programs.

(3) Additional recommendations stemming from the preparation for teaching of the chemistry faculty are found after Table 18.

## XV. OPINIONS ABOUT "METHODS COURSES" AMONG TWO-YEAR COLLEGE FACULTY

**TABLE 15**
**Opinions About "Methods Courses" among 649 Two-Year College Faculty**

| Answers to the question: | Percentage |
|---|---|
| "Do you feel that your teaching would be improved by more methods courses, i.e., courses taught by an Education Department?" | |
| Yes | 19 |
| No | 76 |
| Undecided | 4 |
| No response | 1 |

### *Recommendations Stemming from Opinions about "Methods Courses"*

(1) Methods courses taught by education departments are not well accepted, and this argues strongly that such courses should either be eliminated or transferred to the chemistry department, where they should be taught by a competent chemist-chemical educator. At the very least, the graduate chemistry and education departments should cooperate to produce courses oriented towards the teaching of chemistry to post-secondary school youths and adults. These courses must help the two-year college chemistry teacher understand undermotivated students, the psychology of learning, methods of instruction, etc. as applied to teaching chemistry if they are to be well received. The $AC_3$, ACS, and AAJC should cooperatively construct guidelines

for the development of such courses.

(2) Additional recommendations stemming from opinions about "methods courses" are found after Table 18.

## XVI. EMPLOYMENT OF CHEMISTRY FACULTY IN YEAR PRIOR TO PRESENT POSITION

**TABLE 16**
**Employment of Chemistry Faculty In The Year Prior to Commencing Present Position Two-Year Colleges, 1966 - 1967**

| Status During Year Preceding Acceptance of Position in Present College | Percentage of Respondents to this Question (N=494) | Percentage of Total Group (N=649) |
|---|---|---|
| High School Teaching | 34(1) | 26 |
| Graduate School Student and/or Assistant | 20 | 15 |
| Industrial or Governmental Research | 15 | 12 |
| University, Four-Year College or Professional School Teaching | 10 | 8 |
| Two-Year College Teaching | 10 | 7 |
| Non-research Industrial or Governmental Positions | 7 | 6 |
| Military Service | 2 | 1 |
| Housewife | 1 | 1 |
| Other | 1 | 1 |
| No response | — | 24 |

(1) This figure means that 34% of the 494 respondents to this question left a high school teaching position to enter their present two-year college position regardless of how many years they have been in their present position.

### *Recommendations Stemming from Prior Employment of Chemistry Faculty*

(1) *Institutions and groups* concerned with in-service education of two-year college chemistry teachers must recognize that 80% of the two-year college chemistry teachers have entered these positions from situations in which they would not have immediate contact with what is commonly found in the first two years of college chemistry. Thus the need is apparent for in-service education programs related to the teaching of college chemistry and teaching in a community college.

(2) *Two-year colleges* must provide significant improvements in the teaching environment for chemists if qualified faculty are to be recruited and retained. Improvements needed include the provision of adequate, up-to-date physical facilities, instruments, equipment, and supplies for a contemporary curriculum.

(3) Additional recommendations stemming from prior employment of chemistry faculty are found after Table 18.

## XVII. CHEMISTRY FACULTY TEACHING LOAD CONTACT HOURS

**TABLE 17**
**Chemistry Faculty Teaching Load Contact Hours(1) Two-Year Colleges, 1966 - 1967**

| Number of Hours of Assigned Lecture, Laboratory or Recitation Per Week Per Term(2) | Percentage of Total Number of Reported Loads |
|---|---|
| 8 - 10 hours | 2 |
| 11 - 13 | 5 |
| 14 - 16 | 25 |
| 17 - 19 | 32 |
| 20 - 22 | 25 |
| 23 - 25 | 8 |
| 26 - 28 | 3 |
| 29 or greater | 1 |

(1) These loads do not include the teaching loads of any persons reporting time allowance for administrative duties. They include only those reporting assigned full-time teaching loads.

(2) The load per term is reported since individual's loads vary from term to term and some colleges are on semesters and others quarters. A total of 973 term loads are included.

(3) These data do not include time for out-of-class preparation and grading, setting up equipment and materials, committee work, office hours, etc. When these are considered, the time available for improvement for the 35% with 20 or more is extremely limited.

### *Recommendations Stemming From Chemistry Faculty Teaching Loads*

(1) Maximum benefit from any in-service training programs will result only if the faculty member has the time and energy to participate in them. Two-year colleges must encourage and plan for chemistry instructional improvement and faculty upgrading. A necessary first step is the reduction of teaching loads and the provision of supporting personnel, of both technical and clerical types, to provide the chemistry fac-

ulty with the time required for the improvement of their professional and teaching competence through independent study and participation in chemical education in-service programs.

(2) *The ACS, AC$_s$, and AAJC* should cooperatively study and make recommendations related to the establishment of minimum standards for chemistry teaching loads and academic environment considerations in the two-year colleges.

(3) *Two-year college faculty* should use time gained by teaching load reductions to pursue professional interests rather than non-professional or additional classroom "moonlighting." Valuable activities include independent investigations in chemical education, scholarly or textbook writing, independent chemical research, or cooperative research with a chemist of a nearby four-year college or university. Such activities should afford supplementary professional growth and stimulation rather than replace the teacher's primary role of developing an effective instructional and learning situation through a close student-teacher relationship.

(4) *Foundations and granting agencies* must support such programs as they do university basic research activities.

## XVIII. SUITABILITY OF EDUCATIONAL OPPORTUNITIES FOR CHEMISTRY FACULTY AT NEARBY INSTITUTIONS

**TABLE 18**
**Suitability of Educational Opportunities for Chemistry Faculty at Nearby Institutions Two-Year Colleges, 1966 - 1967**

| Answer to the question: | Percentage |
|---|---|
| "Do Closest Four-Year Colleges and Graduate Schools Offer Courses of Benefit to Your Teaching Which Your Situation Permits You to Attend?" | |
| Yes | 44 |
| No | 38 |
| Maybe | 4 |
| No response | 14 |

*Recommendations Stemming from the Suitability of Educational Opportunities*

(1) *A larger number of graduate schools* need to design and publicize effectively in-service educational opportunities for the nearby two-year college faculty. They should keep in mind that the needs of the two-year college faculty may differ significantly from those of their own degree-oriented students, and cooperate with the two-year colleges in developing the appropriate programs. A continuing regional advisory committee of two-year and four-year college chemistry faculty and department administrators would be helpful in determining the most effective programs. Suggested programs include summer and academic year institutes, conferences, and participation programs. Periodic seminars in chemistry and chemical education devoted to a discussion of specific problems could help minimize technical obsolescence. The "Imitative Institute" type program, held during the summer or academic year, has a great potential for serving other groups of teachers or individual interns or trainees.

(2) *Two-year colleges* must adopt policies and practices which will encourage and facilitate effective participation of their faculty in continuing education programs related to chemistry and chemical education. Faculty participation in such programs is essential to keep the chemistry and methods of instruction contemporary.

(3) *The AC$_s$ and the ACS* must develop, or actively seek out and support the development of, written and multi-media resource materials dealing with specialized and non-traditional topics aimed at increasing both the teacher's chemical competence and his ability to communicate chemical concepts and techniques to his students. Foundations and granting agencies must also actively encourage the development of such materials.

(4) *Research and industrial establishments* or technological institutions could develop co-

operative programs for faculty in-service education related to the instrumentation and other techniques required in meeting occupational curricular needs.

(5) *Two-year college chemistry faculty* have an obligation to participate in continuing education programs designed to meet their needs when encouraged by their college.

## SUMMARY

The statistical data and the recommendations based on these data indicate that there are several major areas in the education and training of two-year college chemistry teachers where action could profitably be taken by various groups. In general, these areas involve appropriate graduate and post-graduate training of chemistry faculty; hiring and retention of qualified faculty; in-service programs and institutes suitable for the updating, stimulation and supplemental training of faculty. The groups that would take action in these areas are the graduate schools of chemistry, the two-year college administrations and boards, organizations such as the American Chemical Society, the Advisory Council on College Chemistry, the American Association of Junior Colleges, and public or private foundations and granting agencies.

These groups might well join together for the purpose of convening a continuing high-level study group to make action recommendations and to make periodic reports on the needs of chemical education in the two-year colleges.

## Condensations of Papers Presented at the Conference on the Development of Teachers for Two-Year College Chemistry Programs

# THE VOICE OF THE TWO-YEAR COLLEGE TEACHER

ROBERT C. BRASTED, *Chairman*, Teacher Development Committee
Professor of Chemistry, University of Minnesota

## INTRODUCTORY REMARKS

The community of college chemistry teachers and indeed the entire chemistry profession has a deep debt of gratitude to each of you for your willingness to meet together and participate actively in this conference. The Advisory Council on College Chemistry specifically, as only one of many groups concerned with the teacher, is grateful for the time and energy which you have devoted to this program and for the skills which you are willing to share in what cannot fail to be a significant step in the improvement of teaching and the teacher.

The Council has, over the past several years, investigated, recommended and in general worked through the mechanism of several basic committees. Each of these committees has utilized freely the services of consultants with expertise in the particular subject under investigation. You are the experts in the area of the two-year college, specifically, and education in chemistry in general. Very early it was recognized that each committee leaned heavily upon and overlapped with almost every other committee and subcommittee. This meeting is a case in point.

The Teacher Development operation, in seeking ways and means of producing the best possible product for the student in our higher education system, joined with the Two-Year College Committee in, first, bringing ourselves up-to-date on the two-year college itself; as important or more so in bringing under scrutiny the profile of the teacher now in the two-year college. This updating was attacked by a not unfamiliar and often times cursed technique of a questionnaire (or two), with the additional aspect of placing the data on computer cards for later interpretation and retrieval. With these data and the additional fruits of this conference it is hoped that we can:

(a) bring into focus the current needs of the two-year college chemistry staff and devise, or recommend, remedial programs where such are needed.

(b) if the data and the conferees so decree, instigate or set in motion plans for new training methods and new curricula to fill the two-year college chemistry department needs of the future, not only in the formal chemistry instruction that may lead to a superior transfer product but to provide the personnel for the important industrial needs in vocational training.

The production of a report of the proceedings of a conference such as this, as personal experience will testify, is a most difficult operation. It often becomes a one-man operation. The plan which has been presented to you should, through position papers, critiques, and the essential manuscript material, provide the foundation for the report which is to be disseminated to the teaching public. The conference, and indeed any conference, is effective only if it benefits the entire community of teachers, not just those here in attendance.

Each of you has been given — or may already have had in your possession — a copy of the Congressional Report on The Junior College and Education in the Sciences, submitted by the National Science Foundation to the Subcommittee on Science, Research, and Development. This was part of the activity of the Committee on Science and Astronautics, U.S. House of Representatives, of the 90th Congress (89-157). This is a remarkable document about which the several Councils were informed when in an early state of preparation. The fantastic amount of tabulated data can only be digested over a long period of time. Since the entire two-year college operation is included, many gaps and inconclu-

sive aspects regarding our profession are understandably existent. At the risk of burdening the two-year colleges administration and the two-year college teacher of chemistry, and even at the risk of some redundancy in other data collected by such groups as the American Association of Junior Colleges and the American Association for the Advancement of Science, the Council went ahead with the data collection and its processing.

Our first formal item of business of this conference will be to hear William Mooney, Chairman of the Advisory Council's Two-Year College Committee, discuss the results of the questionnaire. It is important to understand that the Advisory Council is now in a position to serve as a source of data.

As part of this questionnaire two items allowed, and indeed encouraged, the teacher to express himself in terms of his own needs, his strengths, and ideas that would lead to his and his college's improvement. Often comments do not lend themselves readily to computer input; however, Professor George Splittgerber of Colorado State, William Mooney, and myself have devoted some hours to summarizing and categorizing these comments. In sampling some 320 returns which had significant comments, it might be a useful preamble to the conference to indicate the kinds of suggestions, comments, and criticisms that were found. It is of interest that only one dressed us down soundly for our impertinence in requesting his time and energy for the completion of the questionnaire. It is entirely possible that later speakers will address themselves to many of these items. In the spirit of brevity, I will try to cover only the oft reoccurring items, that serve as the voice of the two-year college chemistry teacher.

1. There was strong endorsement of the National Science Foundation programs for the betterment of the teacher — inferring that what some of us feel might be outmoded or now unnecessarily too broad programs of updating may still be fulfilling a real need. The need for expansion of such programs specifically for the two-year college teacher, a stress on content, and a real desire to hear "master" teachers were all expressed. Any plans which allow a concentrated period of study of subject matter were given approval.
2. A frequent condemnation of the "Big E" programs. This has been said so many times and in so many places that we are likely to forget that our two-year college teachers of chemistry may still be burdened with an overabundance of theory courses in education. There was noted, on enough of the replies to make worth mentioning, that ignoring the psychology of the student is just as dangerous. The student in the two-year college may need far different motivation techniques in the teaching operation than the student in the liberal arts colleges or university.
3. A frequent request for a definition of just what should be in a General Chemistry course. Does this have a familiar ring?
4. What can be done to create a good laboratory?
5. What does the four-year college really want from the two-year college?
6. The role of the geographically centrally located university was questioned. Are useful courses on the schedule for the two-year college teacher? How can good teaching be studied and even emulated? Are *special* summer programs offered or are regular summer programs offered? Could new ones be created in view of the increasing tempo of the two-year college educational process? I may add that as a representative of a large university, I feel that we do have such a responsibility of providing proper courses. Steps are being taken to meet with the many teachers of these schools in our state. A problem even now arises as to where the responsibility in the university *is* lodged — is it the department, top administrative level, college, etc.?
7. The courses of use to the two-year college teacher seem to be disappearing from the bulletins.
8. Could not the Advisory Council act as a clearinghouse for research ideas of use not only to the teacher but for promising sophomore-type students?
9. The matter of instruments and their use was brought into focus many times. What can be done to help the two-year college depart-

ments become equipped at least as well as the undergraduate or lower division departments in the four-year colleges? The need was especially acute where vocational training was stressed. The operators of such tools as NMR, IR, UV, Mass Spec, ESR, etc. are now in high demand and their kinds of positions and skills will be on the increase.

10. The need for some kind of a standardization so that the two-year college teacher of chemistry will have some confidence in what he is teaching and for what particular curricula he is teaching. Is there more than one way to teach general chemistry?

11. The proper use of and instruction in techniques of producing new teaching aids. The entire gamut from film loops to CCTV and tapes are at one time or another mentioned.

12. A frequent denouncement of the caliber of teaching in the four-year college in contrast to the high caliber in the two-year college: — that perhaps the improvement needs to be begun in the former rather than the latter. I have no quarrel with the need in improvement in all places and all levels.

13. A decrying of the overload in the two-year college preventing the chemistry teachers from self-improvement through personal effort and home study.

14. An advising problem in the four-year college: — delaying a choice of major until well into the four-year program, thus, how can the two-year college prepare transfer chemistry majors?

15. The upper division course problem; the transfer of credit for organic and physical, especially the former. Many four-year colleges will not accept the one-semester organic chemistry often taught in the two-year college, a fact that is bitterly resented, with justification, by the two-year college teacher.

16. Where does the course content become established and standardized for the vocational and technician courses. A related problem — how does a two-year college produce a chemistry curricula that will satisfy the spectrum of say, that required in a hotel management course to the traditional chemistry major?

17. The need for logistic aid in developing the laboratory operations that are so important if proper experimental work is to be done — open labs, unknowns, equipment, instruments and supplies, as well as the imaginative experiments.

I hope that what has been brought out by the questionnaire will be considered as the voice of the teacher; that their needs will be considered and met.

# THE PRESIDENT VIEWS THE CHEMISTRY FACULTY

STUART E. MARSEE, *President,* El Camino College
Via Torrance, California

The quality of a college is directly related to the quality of its faculty so its selection should be of serious concern for all colleges. The success in the recruitment of qualified teachers depends upon the attractiveness of the institution in terms of academic and economic security, prestige, opportunity for professional growth, and "on- and off-campus" community environment.

El Camino College has more than 15,000 full and part-time students; 350 full-time faculty, 14 of whom teach chemistry; a district of approximately 500,000 people; and an assessed valuation over 1.3 billion dollars. The college is 21 years old and serves much of southwestern Los Angeles County. It is located within an hour's drive of two major universities, three large state colleges, six private colleges and universities. The neighboring four-year institutions supply faculty candidates and provide opportunities for faculty enrichment.

At El Camino College, sometimes called atypical but not nearly as different as many believe, a philosophy has been evolved and several practices developed which enabled this large metropolitan area junior college to recruit successfully and retain a high quality faculty. Interested in both the teaching of chemistry and the students, well prepared in chemistry, professionally active, the faculty is successful in preparing students for transfer to other institutions as chemistry or science majors. Its students are employed by chemical and related industrial laboratories as semi-professional employees.

El Camino views recruitment of faculty as a continuous job and attempts to remain competitive with other Southern California two-year and four-year colleges in salary, fringe benefits, teaching load, supporting services, physical facilities, equipment, class size, teacher recognition, and other features which make teaching attractive.

Although a large institution instructionally, El Camino College has many of the advantages of smaller colleges. It maintains small classes with 24 to 30 in science lectures and laboratories and the same instructor has the students in the lecture and laboratory. There is emphasis upon the importance of laboratory work as evidenced by the inclusion of large blocks of laboratory time in chemistry courses; the provision of capable assistance; quality equipment; and the instrumentation for such laboratories. The president can, and must, be a positive force in maintaining such conditions, thus making possible instructional programs that will provide close faculty-student relationships and entice quality instructors to seek employment.

Other institutions, professional organizations, and prominent persons are kept informed about the college and its chemistry program. Faculty and administration are encouraged but not required to publish. Conference attendance by faculty and administration is supported. The administration is decentralized with ten instructional divisions. The divisional dean, a third-line administrator, is charged with the responsibility of giving leadership to the faculty of a division. He is responsible for the divisional faculty selection and retention, in-service education, faculty and student performance, and curriculum and budget development. The dean is responsible for developing contacts which will be fruitful in terms of applications for faculty positions, for preliminary screening, for personally checking employment references — an extremely vital process in quality control — and for narrowing the field to a final few who are interviewed by the administrative selection team. Deans are encouraged to involve knowledgeable faculty members in the screening process. The employment of local residents to teach part-time has proven a valuable way of evaluating their work before recruiting them for the full-time faculty.

El Camino College is concerned with the faculty members' scholarship, depth of specialized and breadth of general knowledge, command of English and ability to express thoughts, previous

success, physical fitness and grooming, and personal characteristics and attitudes. The college looks for faculty with an understanding of and commitment to the philosophy of the open-door, comprehensive junior college. Community participation by the faculty and an intimate knowledge of the goals and resources of the institution are stressed. The chemistry faculty member must be able to accept students with broad ranges of ability and motivation, be sympathetic to a wide range of curricular programs, and be willing to adjust to a teaching assignment that may not represent the highest academic level, since general chemistry and other introductory chemistry courses dominate the curriculum.

El Camino has added four full-time faculty members to its chemistry department in the last ten years. Only one person left the department in that period to go to a new junior college after obtaining his doctorate in chemistry on a study leave.

Although research experience is desirable and, perhaps, necessary in developing an understanding of science, El Camino has not found that for excellence in chemistry teaching a Ph.D. degree is required. The master's degree in chemistry has been found acceptable and desirable. Although a two-year college teacher need not be research oriented, in the chemical research sense, this does not minimize the critical importance of a dedication to creative teaching skill and to the development of innovative thinking. Faculty members are encouraged and assisted in the pursuit of advanced or additional studies, especially as they pertain to strengthening areas of weakness related to their work, as well as keeping up-to-date.

At the time of employment at El Camino, three of the fourteen chemistry faculty had the Ph.D. in chemistry; seven the M.S. in chemistry, one of whom has since received the Ph.D. in chemistry; and four the bachelor's degree in chemistry, two of whom had the master's degree in biology and two in education, both of whom have since obtained a master's in chemistry (one is nearing completion of a Ph.D. in chemistry). Before joining our faculty, four of the group were teaching in high schools, four in junior colleges, two in universities, one at a four-year college and three came from industry.

Even if all two-year colleges were to provide the favorable teaching environment and hold the quality control on the selection and retention employed at El Camino, the problem could not be solved until a larger pool of qualified manpower is made available. The problem may become worse, since 30% of the lower division students are currently educated in two-year colleges and the percentage is increasing.

The fact that nearly 45% of the two-year college chemistry faculty has come from high school teaching or from other two-year colleges, suggests that improvement in the teacher preparation for high school chemistry and for the two-year colleges needs a joint solution. Hiring from such sources does not expand the manpower pool, it just swirls it around. The best place to expand the pool of talent available for such teaching is to concentrate on recruiting students completing or leaving graduate school, chemists working in industrial and governmental laboratories, housewives, etc. To increase the yield from these sources, more two-year colleges will have to make chemistry teaching considerably more attractive. This will probably require a reexamination of the requirements for teaching and of the academic environment in these institutions. The Advisory Council should consider ways in which it might provide constructive leadership in increasing the qualified manpower pool for chemistry teaching in the two-year college which might well include the above mentioned reexamination.

# EDUCATION AND TRAINING BEYOND THE BACHELOR'S DEGREE NEEDED FOR TEACHING CHEMISTRY IN THE TWO-YEAR COLLEGE

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Post bachelors' degree education and training of two-year college chemistry faculty should improve their competence as chemists as well as enhance their ability to explain chemistry to students and lay persons unfamiliar with this field.

The master's degree in chemistry is increasingly being required as the minimum preparation for teacher certification or employment and should be considered minimal for anyone employed to teach chemistry in a two-year college. Both the "course work only" and the "research oriented" master's degrees are satisfactory but the latter is preferable. Chemistry instructors should be aware of how to proceed in solving a chemical research problem. Unless one has tackled a research problem, he may fail to appreciate and understand the methods by which our knowledge of chemistry evolves and expands.

Teaching assistantships should be more effectively utilized. They should develop instructional competence, be a stimulating educational experience, and contribute to the development of the assistant's skill of communication with unfamiliar chemical concepts. The assistant should be introduced to a variety of teaching and instructional methods in chemistry and be given added responsibility in the conduct of course work. Assistants should observe team teaching, modern audio-visual techniques, and new chemical education methods. More effective supervision of teaching assistants by a master teacher is needed.

The question, "where do graduate students learn the 'non-bench' research for careers in chemical education?" was posed. New programs for special groups, such as two-year college faculty, either in or outside the university chemistry department, are not required. Present graduate programs can and should be directed to the task of educating the student to be a more versatile individual, capable of entering with some proficiency any area of chemistry rather than limiting him to work in some particular field.

A different point of view expressed was that the graduate schools should start thinking about programs for people who would like to be teachers. Large university graduate schools tend to admit students with the best grades, recommendations, and from the best schools; place them in common courses during the first year, and then attempt to weed out the scholastically weak. Graduate schools should also recruit people interested in careers in chemical education, design programs which would develop them into effective teachers of chemistry.

The key to effective in-service education is the teacher's awareness of his need to keep up-to-date with new subject material and the innovations in teaching methods; therefore, the two-year college must encourage the individual faculty member who recognizes his need to participate in endeavors designed to satisfy such needs. The colleges should reexamine their policies on educational leaves, salary advancement, rewards for increased teaching effectiveness, and faculty research to be sure they are offering such benefits. The master's degree should not be considered the terminal academic degree for two-year college chemistry teachers. Capable faculty should be encouraged to obtain a doctorate in chemistry.

Some people believe faculty who return to graduate studies and obtain the doctorate in chemistry will leave the two-year college. Evidence indicates that a faculty member who has five or six years experience at the college will usually return. However, those with fewer years of service may well move to a four-year college or into industrial or governmental research.

Many two-year colleges discourage research by the chemistry faculty and this position should be examined. A suitable research problem can help keep a faculty member aware of developing ideas in his field and improve his effectiveness as a teacher. Well-chosen research prob-

lems can be examples to students of the type of activity in which they will be participating should they choose to continue their studies in chemistry. Two-year colleges should not require their faculty to do basic research but they should make it possible for their faculty to conduct some suitable research as an adjunct to their primary teaching obligation. Such a change would make the "research oriented" master's even more desirable.

The concept that research in chemical education is just as valid as any other kind of research is needed in the universities. Such a philosophy would stimulate interest in chemistry teaching. Experimentation with new instructional techniques should be an adjunct to the present basic research programs within graduate chemistry departments. Specific research to improve the organic chemistry laboratory is a real need.

In cases where the two-year college faculty find it difficult to engage in research because of the lack of suitable equipment, they might establish cooperative research projects with nearby four-year colleges, industries, or government laboratories.

College faculty find it difficult to keep up-to-date in chemistry and chemical education, as well as engage in research, because of heavy assigned loads (18-21 contact hours per week with several preparations, large numbers of students, little technical or instructional assistance, plus other non-chemistry teaching assignments). In these cases it was suggested that loads should be measured by how many hours a week one is engaged in activities required to carry out his assigned work, and that this be considered in establishing loads. Another suggestion was that the faculty load be in terms of the number of assigned students and the responsibility for their learning.

# OCCUPATIONAL PROGRAMS IN CHEMISTRY

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With new community colleges opening at the rate of one each week and emphasizing occupational training, the number of qualified occupational education teachers and administrators is too small to meet the need. Staffing technical programs, such as chemical technology, is difficult since these teachers must have technical competence and be able to relate the principles being taught to industrial practice. Experience shows this is done most effectively by persons having experience in the occupational field and an understanding of the special educational needs of these students.

Post-secondary school occupational education is neither higher education nor vocational education in their traditional forms. Professional teacher education programs are needed which deal with the unique characteristics of occupational education. People who can plan programs, organize curricula, develop laboratories, and supervise instruction are needed for professional leadership roles. The professional background for such work is yet to be defined, especially in chemical technology.

Oklahoma State University offers a Bachelor of Science degree in Technical Education, designed for Associate degree graduates in Engineering Technology; Master of Science degree in Technical Education, for graduates of engineering, physical science, or the B.S. in Technical Education curricula; and a doctoral program in higher education, with specialization in occupational education. This program prepares students for either teaching or industrial positions. The increasing enrollment and the commitment of the graduates to teaching (fifty percent go into teaching) may be a result of the recruiting system. The Associate degree graduates enter the professional study program with a substantial technical background and well defined interests in a field of specialization. They have an understanding of the unique educational objectives and instructional processes of technical education. The most successful teachers in Oklahoma two-year occupational programs are graduates of these same programs, who have obtained experience in technical occupations and advanced technical and professional training.

The requirements for the bachelor's degree include (1) 30 semester hours in specialized technical courses, usually a part of the associate program; (2) 10 hours in related technical courses such as drafting, metallurgy, etc., also in the associate program; (3) 26 hours in mathematics and science; (4) 14 hours in upper division engineering or science; (5) 13 hours in technical education, including professional courses for technical teachers dealing with the philosophy of technical education, occupational analysis, instructional processes, and program planning; (6) 17 hours in general education; and (7) 16 hours in electives.

Oklahoma State University has not used either work-study, half-time study and half-time work, or cooperative education (work one term and study one term alternately) as a method of coordinating the upper division or graduate studies and the occupational experience required. This is because of isolation from industrial centers, but if such cooperation were feasible, it would be sought.

The Advisory Council should encourage and promote special institutes for teachers in chemical technology and encourage basic research studies that would identify the unique requirements of instructional programs in chemistry with occupational objectives. There will be an increasing need for semi-professional personnel in the chemical field and much needs to be done to develop the quantity and quality of occupational education services needed in future years.

Educational goals in American life are dominated by the bachelor-doctorate stream line, and students tend to go as far as they can along this path, then drop off and go to work. An alternative educational goal is needed for many persons. The completion of an associate degree

program leading to immediate employment in a specific occupational career is an attractive alternate since such programs produce persons who have achieved their educational goal and who are content working in their chosen occupation. Two-year colleges emphasize transfer programs for economic reasons and because it is easier to determine how successful the student is when he transfers.

The meager supply of competent chemical technologist teachers is in contrast to that of electronic technician teachers where there are many capable and interested individuals with service and industrial experience in advanced electronics work. Few present two-year college chemistry teachers have had industrial experience and most have had only academic experience. Thus they appear to be minimally qualified to teach potential chemical technologists in occupational type programs.

Internships in industry have been proposed as one way of providing industrial experience. An alternative may be found in a Ford Foundation program through which industrial chemical engineers teach part-time, three to five hours per week, in chemical engineering schools. The stimulation extends beyond the students who take a course from a practicing industrial engineer. It carries over to the informal discussions between the faculty and the visiting scientist.

If a similar program were available to two-year colleges, practicing industrial chemists might teach in the chemical technology program. Secondary effects which might result, in addition to the primary aim of effective industrial chemical training, include: (1) establishment of a closer liaison between local industry and the college in determining the needs of industry for such personnel and the training required; (2) increased support in the presentation of the equipment needs and necessary qualifications for chemical technologists; (3) establishment of a feedback system to inform the college on how well the students are performing in industry; and (4) improved recruiting of industrial chemists to full-time occupational program teaching positions. The wages and opportunities for chemical technologists in the local area could increase more rapidly as local industry becomes better acquainted with the quality of the students and teaching in the local program.

Another potential source of chemical technology faculty is the research technologist who has advanced from a chemical technician to a salary and opportunity level approaching that of the degree chemist. Persons who combined such industrial experience with a technical education program such as at Oklahoma State should be able candidates for occupational program facilities.

The growth of enrollments in chemical technology has not matched that in other occupational programs in the metropolitan community colleges. A reasonable explanation appears to be that the difference between a B.S. in chemistry and a chemical technologist is less well defined than the difference between the professional and the technologist in electronic and mechanical technology and engineering. The rigor in the transfer and the technology programs is so similar that students can slide either way during or at the end of the two-year program. There is a great diversity in what a chemical technician is and does in various industries whereas the role and duties of electronic technicians appear to be better standardized. Some chemical industries also do not appear to know how to effectively use chemical technicians or to articulate their requirements for such personnel.

There are many real problems when a college offers separate programs in chemistry for transfer students and for occupational students. Perhaps we should look carefully at these differences and see how much similarity and difference really needs to exist. Perhaps, two-year colleges could teach a course emphasizing the principles of chemistry and their application in the first year to both groups of students and then differentiate between the groups in the second year or a portion of the second year. It is conceivable that if we were to educate and train chemistry teachers to teach a course in which they fuse the principles and the applications that this might also be the best course for the transfer program in the first year, considering the type of student which predominates in two-year college chemistry classes.

# A GRADUATE PROGRAM FOR COLLEGE TEACHERS

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An immediate clarification of the title is necessary. The degree program now in operation at the University of the Pacific leads to the Doctor of Philosophy in chemistry and not in "Teaching." The author wishes this point made clear, that though there are aspects of the program that make it admirably suitable to those wishing a career in college level teaching, the "end product" is also equipped to enter government or industrial research.

The University of the Pacific program has evolved (and even now is undergoing constant change) over the past 20 years from an essentially nonresearch (at least in the classical sense) Doctorate or Teaching Degree to a degree curriculum that demands the same research concentration (approximately 50% of total time) as would any "chemical" doctorate program. It is fair to say that the original plan was criticized by the American Chemical Society. Feedback from the recipients of the presently administered program leads to the conclusion that the research experience is valuable and should not be changed even though the teachers may be in a situation that now is not demanding in research.

Over the decades since World War I, the trend in Ph.D. training has been away from preparation for teaching and toward industrial experience and specialization. The needs which are becoming acute in our two-year colleges are not being met with the current training of the Ph.D. The University of the Pacific program, as described, produces a person able to move in either area, though the candidates are strongly motivated toward teaching with most of them having had long experience in a teaching environment. These people are not in need of extensive new education courses.

It is necessary for most Ph.D.'s who enter teaching to depend upon their own undergraduate course work since there is nothing in the Ph.D. training (other than experience in the teaching assistantship) that would prepare one for this phase of instruction.

The primary points of departure (extension is perhaps more descriptive) found in the University of the Pacific program from the "classical Ph.D." are:

1. A strong emphasis placed upon a Teaching Seminar
2. A course in "Apprentice Teaching"
3. A somewhat increased course load over a broadened base
4. A basic atmosphere and attitude on the part of the candidates since they are already motivated toward a common goal of instruction.

It is logical that a somewhat increased tempo of course work should be found. Many of the candidates, as they enter the program are farther removed from their formal training than the usual first year graduate student. It is also likely that the recipient of the degree will devote much of his future instructional time in the General Chemistry area and thus inorganic specialization is common.

The seminar includes work in audiovisuals, film making, evaluation of materials from the Advisory Council and Journal of Chemical Education, a concentration on history and philisophy of science.

Innovation and research in teaching fundamentals might well originate with the two-year college chemistry community as well as liberal arts and state college departments. In the University of the Pacific program there have been some 100 successful candidates, most of them are found in institutions of higher learning. These holders of the doctorate would be in an ideal position to describe their feelings on how a standard doctorate (if such exists) program might be modified to suit the needs of the teaching profession. It is likely that the graduate schools (the Deans and the Graduate Group Committees) of the country might themselves benefit from some "education" on ways and means of producing a doctorate with training features, including modifications and innovations that would equip an individual to meet the needs of the teaching profession.

# NEW DEGREE PROGRAMS OF POTENTIAL INTEREST TO THE TWO-YEAR COLLEGE CHEMISTRY FACULTY MEMBER AND ADMINISTRATOR

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Reform in the administration and curricula of the Ph.D. degree to better fit the needs of the teacher may be dated to the turn of the century. (William James in 1903 made such suggestions.) Two trends seem to rise in a study of teacher training. One suggests little change other than an intermediate degree upon admission to candidacy (Master of Philosophy, Candidates Degree, Candidates Certificate, Doctor of Arts, etc.). The other suggests a revision of the Ph.D. to include a more specific stream of study for teaching. A need for reform of some kind is evident from the near 50% dropout in all fields with the figure being smaller in the sciences. For the most part, the dropout represents an "all but dissertation" level.

The usual "course competency" of the graduate student who completes all but the dissertation (perhaps performing at an unsatisfactory level at the preliminary examination) is equal to and often considerably higher than the master's candidate. The "Candidates Certificate" or "Candidates Degree" (the first mentioned trend noted above) then may well be considered to represent a higher level of proficiency than a subject matter master's degree. This candidate's degree (under its several names) should be considered as more of a philosophical than a professional degree. A number of universities have taken the lead in its use – the University of Minnesota, Northwestern, Michigan, California (Berkeley), and Indiana (with its Candidate in Philosophy). A master of Philosophy has been awarded to recognize a state of development by Yale, Rutgers, and Toronto. A candidacy status is of course an inherent part of the European system. The doctorandus is descriptive of the person who has essentially completed all phases of the doctorate but the thesis. There is the possibility that a Candidacy (degree, certificate, or diploma) may, in this country, never reach a state of meaningfulness or even respectability.

The Master's degree would appear to come closest to defining the teachers qualification for two-year college. Variations that are now found lean on the theme of the Master of Arts in Science Teaching. It is possible with such a degree to design curricula and to recognize actual needs without the creation of new patterns and unfamiliar "letters." The University of the Pacific program is different in that the requirements of this institution are those of the Ph.D. as we now accept them, plus an internship and certain seminars which would be beneficial to the teachers. The basic problem remains in that sufficient numbers cannot be trained under these admittedly high standards.

The Doctorate in Education (EdD) has long been in existence. Penn State, Oklahoma State, Minnesota, and others have a subject-oriented EdD. The community of two-year and four-year college teachers do not seem to find its requirement realistic or desirable for the situation under consideration here. A Ph.D. offered at Oregon State University has long been in use with curricula designed to train for the broader spectrum of so-called general science. The recipient fits well into a state college department where a responsibility lies for all of the mathematics and science – not an uncommon situation. A danger lies in a two or more track system resulting in a lowering of the Ph.D. level.

An as yet untried program designed for the college teacher leading to a doctorate, but one which seems to be feasible, is briefly described as follows:

1. The first two years would be on a common program whether the research oriented or teaching degree is sought. The course work and examination programs would be identical. The "Candidate's Degree" would be awarded at this point. Within this two-year period, an opportunity would have been provided for the candidate to initiate a research project and to have enough experience to make the

decision whether the full course of time should be devoted to research or whether the teaching system would be more suitable to his talents and future.

2. The third and hopefully final year would include (assuming the "teaching stream" is chosen):

(a) Presentation of research results as far as they have been carried.

(b) Preparation and presentation (defense) of an extensive review type paper. This would be important to the degree since the teacher is in a sense more of an interpreter of knowledge than an originator – the middle-man between the research scientist and the student.

(c) Some additional work in the history and philosophy of science.

(d) A teaching internship.

(e) A working experience through courses or internship in instructional media.

(f) An opportunity to widen his scope into an interdisciplinary science course (e.g., biochemistry, chemical physics, geochemistry).

The suggested degree would be the Doctorate of Science, DSc.

Such programs, whether they be the EdD, the DSc (as described above), MST, or MAST, assume some arbitrary difference between "teaching" and "research." Such a difference is worthy of much debate, since many would consider that a student is being "taught" when he engages in a thesis project. Realistically, the communication that is so badly needed between the teacher and student is difficult to realize when the mentor is usually heavily engaged in the direction of many problems, administration not only of research contracts but perhaps of departmental operations and off-campus activities. It is then inevitable that there has arisen a two-class society. It is unfortunate that the two cannot occupy "degenerate" levels. Some unknown factors have led to an assignment of the research group to a different and supposedly higher "energy" level than that occupied by the teacher.

# SPECIAL PROGRAMS DESIGNED FOR THE CONTINUING EDUCATION OF THE TWO-YEAR COLLEGE FACULTY MEMBER

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As a preamble to this topic, it is urged that the junior college should not become a research oriented institution. That is, the "continuing education" here considered should not be directed toward research participation. It is suggested that some of the current lack of interest in the student toward chemistry as a major may be due to the limited time a university or even four-year college teacher has to spend in individualized instruction. The general qualities likely to be found in the two-year college student may be such that individual attention is of great importance. These institutions should now be and remain teaching oriented.

Six aspects of continuing education serve as a skeleton for the discussion.

1. The need, does it really exist? The breadth of the responsibilities of the two-year college instructor make clear that continuing education *is* necessary. These needs are not only in the subject matter of the introductory courses which is in a constant state of flux and advancement, but in companion areas of teaching. Problems of advising and counseling are acute at this level since the several streams open to the two-year college student need to be familiar to the counselor as well as the relationship to the neighboring universities and four-year colleges regarding credit transfer, course content, consolidation of disciplines (e.g., physics-chemistry, chemistry-biology, physics-geology, etc.).
2. The content of the courses to be taught underlies almost every part of the two-year college program. Who is to decide on text content? Can the student, with the capacity to learn and preparation common to many two-year college freshmen, survive in a course addressing itself to the level suggested by many of the new texts? The attrition in the transfer type course infers that perhaps this kind of context is not proper. In several junior colleges reporting data, the attrition approaches an unbelievable 80-90%. (Two examples are: 6 students remaining in a starting class of 40; 35 students remaining in a class of some 350). It is hoped that these are atypical figures but it is certain that the loss is far too high.
3. If a program is to be offered, where will qualified teachers be found to present it? A concurrent problem is to sell the continuing education plan to the administration of the university or other institution where instruction is physically located. Unless it is associated with a degree it is not likely to be well received by the graduate school. Even the vice-president for financial affairs will have a say in whether it is economical. The ever present question of multilevel facilities is raised here also. Will the instructor in the continuing education program drop in his "respectability level?" It would be hoped that the electron energy degeneracy principle could be evoked for both the area of instruction *and* research since indeed a staff member with a research group is acting as a teacher in the truest sense of the word.
4. The timing of continuing education is a problem of no small consequence. The modules of the National Science Foundation programs have been in operation for many years. We have the Academic Year Programs, the In-service Institutes, the Summer Institutes and Conferences. The number of those available for two-year college teachers has never been great nor the programs well designed for their use. There are an insufficient number of useable courses in night and extension divisions of universities. These programs do, in certain geographic areas, present a method of continuing education. The financial support of the two-year college teacher in continuing education is at best uncertain. Few of the new colleges have as yet decided upon sabbatical programs. Likewise, few have sufficient members

of the staff to allow a person to take a leave or sabbatical without hiring a new person. Several universities function on a workable and successful plan of bringing in two-year college or four-year college teachers for a year, using either assistantship funds or funds accruing from sabbatical leaves. The teachers participate in the instructional program in whatever discipline he is the most familiar. The load is limited to no more than a course a term. Time is then available for special seminars, courses that will bring him up-to-date in a field, and a chance to observe whatever may be of greatest use to him in this environment.

5. What is the structure of such a program as described in (4) above? The answer, insofar as they are presently run, is that they are quite unstructured. No degree is offered, though it might be possible for extra course credit to be earned if the visitor operates in his home jurisdiction on a "degree plus X hours" plan. The natural question is raised, would the university or four-year college teacher be willing to operate on an exchange basis, where he would teach at the two-year college for a year under the same circumstances (load) as the two-year college teacher?

6. Ultimately the question is raised here as should be raised in any operation, how do we evaluate the success of a continuing education program? Unfortunately we have seen in some of the secondary schools a sign of success when the teacher at this level has decided to leave this environment to enter the two-year college because of the success of his own continuing education plan. This is to the credit of the teacher. The same situation exists, though perhaps to a lesser extent, in the movement of the two-year college teacher to the four-year college. Other than these very unquantitative observations, there is probably no good way of evaluating a program. There are not enough of them to permit case studies. Perhaps in the future there will be an increasing number of institutions and teachers willing to provide the needs that are being voiced. It is dangerous to limit the thinking of the continuing education only to the teacher of the courses thought of as potential transfer types. Neither in this conference nor any other known by the conferees is there a concerted effort to supply the needs of the vocational teachers.

# THE IMITATIVE INSTITUTE

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The "imitative institute" is but a translation of one of the most ancient of teaching devices — the apprenticeship. The particular form to be discussed was outlined first by the late Professor Ludwig F. Audrieth at the University of Illinois, developed by Professor Audrieth, the writer, and several associates during five National Science Foundation-sponsored Summer Institutes for high school teachers of chemistry (at the University of Illinois, Urbana), and named, if my memory is correct, during an Advisory Council conference.

The imitative institute operates by bringing its participants into the fullest possible contact and confrontation with a course of study which is very much like the course they will later be expected to teach. The participants attend all the regular lectures in the course and perform all the work normally required of the students in the course (except the laboratory work may be abbreviated). In addition, each lecture, laboratory, and quiz session is followed (or preceded, if that would be expedient) by a special session limited in attendance to institute participants and staff during which current work is discussed and dissected in detail. There is assumed both the concept of content and of methodology in the imitative institute. The registrants for the most part are assumed to be aware of subject matter. However, the new teacher or the teacher entering a new field, as has been already discussed, may benefit from this kind of approach.

The desired result is that each participant in the institute, upon its successful completion, be qualified to teach in his own institution the content of the course by imitation of his own intensive experience.

It is not expected that the teacher of the institute will operate only through the medium of the lecture. It is obvious that there are often better mechanisms of instruction than a 50-minute lecture. When it is to the best interest of the understanding and transmitting of material to use new and experimental educational aids, it would be expected that the imitative institute teacher would use such.

Most instruction is based upon a philosophy of understanding; that is, the student is brought into contact with material which he is expected to understand in breadth and depth, and this understanding at each stage is the foundation upon which succeeding presentation of material is based. The feasibility of the institute and its utility may ultimately depend upon the attendees capacity to extrapolate the material and the approach given into a new environment. Typically (except, perhaps, in advanced graduate courses), a teacher is expected to be overeducated to a greater or lesser degree; that is, he is expected to have mastery of the material he teaches by virtue of his understanding of and ability to apply material of much greater sophistication and difficulty at a lower level. Because of the rapid trickle-down of material from advanced courses to those nearer the introductory level, a teacher endeavoring honestly to maintain or increase his skills in this manner must devote himself to the mastery of topics considerably more advanced than those he teaches, though related to them.

This pattern ignores certain realities, especially in its application to teachers in secondary schools and in colleges where the teaching load is heavy. First, the teacher usually does not have time or energy for continual "retreading." Second, the pressure of time creates an attitude summarized conveniently in the question, "this is very interesting stuff, but what part of it is really important to my students, and how do I present it to them?" Third, a teacher's most effective detailed knowledge of specific subject matter comes from answering the questions he asks himself as he prepares to give instruction.

An imitative institute experience provides the teacher with a complete, tested, effective package of topical coverage and related learning work through his participation in a specific course like the one he will be called upon to

teach. The special sessions afford him the opportunity to ask and have answered the questions he has himself and the kinds of questions he anticipates his students will ask him. The understanding he achieves at that time should be particularly germane to his own instructional requirements and during the institute is strongly focused by teacher-generated pragmatic considerations.

A kind of material that might be incorporated in the imitative institute, and indeed in any kind of course, is not only what *do* we teach but what are the things about which we *do not* know enough to teach – that is what is unknown in our discipline.

It may be argued that this kind of preparation yields a teacher who is a kind of witless tape recording of his subject; and, that when he plays himself back his students dare not push him beyond the confines of the tape, for nothing will be there to give them satisfaction. This may be a a real hazard the first time the teacher goes through the course on his own, but such hazard exists even when more conventional techniques for preparation are employed. The principal advantages of the imitative institute approach are that the teacher is not required to make his major efforts the prosecution of tasks likely to be especially difficult and time-consuming for him: outlining, reduction, and re-synthesis of material learned at one level for instruction at another. For the teacher, repetition of his cycle of instruction should be just as productive of additional insight and deeper understanding as it always has been.

Two groups of people should benefit most from this kind of approach; (1) the seasoned instructor who has not had the chance to update his material for a number of years, especially in general chemistry, though by no means limited to this kind of material; (2) persons intending to enter teaching for the first time after initiating or even completing a career in other chemical areas. A strong point in favor of the imitative institute is a somewhat indirect one, the seasoned lecturer and especially the institute lecturer will have a chance for a critical evaluation of his own course. A strong base for evaluating content is provided, in addition to the move obvious benefit to methodology. If properly operated the plan would give a broad base of subject matter improvement rather than a concentration on narrow fields.

Caution is suggested in that there may not be sufficient stimulation for the conferee, especially one from the two-year college. It is hoped that such an approach would not act to stifle new approaches, and most certainly the "students" should not feel that there is but a single method of presenting a course. Teachers from different kinds of institutions would find that all of the material being scrutinized by this technique would not be applicable to the students with whom he deals. There is some danger that the approach used is so unique as to give this kind of institute a second-class status. One can argue certainly that a hierarchy exists even now in institute programs, based upon either level of preparation of the registrants or level of material presented.

Probably because of the limited experience or lack of public knowledge on the imitative institute, it is not possible to deduce how efficiently a registrant's time is used during the period of the program. It is possible that a part of the time in almost any of the usual college or high school institutes now operating could profitably incorporate some of the aspects of the imitative institute.

# THE ROLE OF THE STATE COLLEGES IN THE EDUCATION AND TRAINING OF CHEMISTRY TEACHERS OF TWO-YEAR COLLEGES

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This paper reviews the present status of two-year college teaching, considering the challenge of such a position, the deficiencies recognized by present teachers in their training, the supply and demand for such teachers, and existing programs for teacher training. It then concludes that state colleges are uniquely qualified to provide programs which will turn out superior two-year college chemistry teachers. This is justified on the grounds that historically state colleges have been teacher-training institutions. Teacher training for primary and secondary schools is still one of their principal functions, but they have now moved into graduate work in chemistry at the M.S. level which offers adequate depth in subject matter for teachers in two-year colleges. Also, since the state colleges are not placing such large stress on original research as are universities offering the Ph.D. degree in chemistry, they are thus able to give substantially more attention to the special problems of college-level teachers.

It is proposed that state colleges and two-year colleges work together in developing optimum combinations of core courses required for instructors in two-year colleges. Presumably this will be essentially the present M.S. program in state colleges with breadth in subject matter rather than depth, permitting some degree of specialization via a research problem in the subject area.

In addition to the basic M.S. program, a teaching internship at a two-year college under the joint supervision of two-year and four-year college personnel is proposed. This internship is intended to relieve present two-year college teachers of part of their heavy teaching load and to provide a working relationship between personnel of two-year and four-year colleges.

The arrangement will provide for some faculty exchange and will improve the research opportunities for two-year college people. It is argued that the four-year college thus can offer the same sort of services to two-year college personnel that universities now provide for four-year college people both in initial training and in continuing education.

Conversely, many feel that universities are *not* indifferent to the problems of two-year college teachers and may be just as well qualified on the basis of interest and responsibilities to take part in the training of two-year college people. Also, it may be argued that a rigidly imposed set of core courses for the training of two-year college teachers will stifle the evolution of innovative programs. An M.S. program containing a set of prescribed core courses might meet the need of some two-year college teachers, but others might be better served by a less traditional distribution of courses. Especially, a need for two-year college teachers with more than the normal emphasis on biochemistry is now recognized.

Perhaps the internship program as outlined is too formal and restrictive and borrows too much from the practice teaching courses given to secondary school teachers. Competence in chemistry is the most important single qualification for a teacher of two-year college chemistry.

The rapid turn-over experienced by staffs of many two-year colleges is already of concern. Will the proposed internship add an excessive load to the training program and make it even more difficult to secure able, continuing personnel? The concensus holds that no special program for the teacher in two-year colleges which differs from that needed by other college teachers is necessary. Hence it may be argued that anyone taking an M.S. degree with a research thesis requirement might better go to the school which will give him the best research training, whether a university or state four-year college. There is general agreement that course work should generally have breadth if it is to prepare a two-year college teacher for the situation he is likely to face.

# THE ROLE OF THE COLLEGES OF EDUCATION IN THE TRAINING OF CHEMISTRY TEACHERS FOR TWO-YEAR COLLEGES

STANLEY E. WILLIAMSON, Oregon State University
Corvallis, Oregon

The predicted demand for teachers in two-year colleges makes it obviously impossible to meet the need from the ranks of Ph.D.-trained people. Hence, competent teachers must be sought who have not received the conventional Ph.D. degree. Colleges of education have an important contribution to make in this effort but must develop programs which differ significantly from those now provided for primary and secondary school teachers.

Four major problem areas exist for cooperative study by chemistry departments and colleges of education:

1. The recruitment, selection, and retention of cooperative junior college teachers of chemistry.
2. Identifying the rationale for junior college chemistry teaching. (Teaching is the prime function of the two-year college teacher.)
3. Planning effective programs for the preparation of prospective junior college chemistry teachers.
4. Planning for needed research in teaching junior college chemistry.

Teaching has been defined as creating an environment in which maximum learning can and will take place; also as any interpersonal influence aimed at changing the ways in which other persons can and will behave. Thus, teaching is "causing learning"; it is the single indispensable act in the educational enterprise.

The generally accepted prerequisites of good teaching are:

(a) A good teacher has breadth and depth perception of subject matter.

(b) In good teaching the instructor is sensitive to the individual needs of the students.

(c) A good teacher has an air of self-confidence in his subject area and has enthusiasm for his field.

(d) A good teacher believes that students have the ability to learn and comprehend what has been taught.

(e) A good teacher attempts to see himself as others see him.

The recommendations of the Carnegie Foundation (1958) on the preparation of prospective college teachers included the following:

(a) Required competence in chosen subject-matter field.

(b) Acquaintance with the skills, techniques, and methods of teaching.

(c) Familiarity with the important ideas and issues in educational psychology.

(d) Teaching experience under the direction of outstanding professors in the field.

(e) Understanding the scope and nature of American higher education.

The joint efforts of educators and chemists are needed to develop chemistry teachers who will measure up to these standards. Especially such joint effort is needed to develop meaningful experiences for graduate students in classroom teaching under guidance. The use of clinical professors is now deemed essential, and there is need for field experience to prove the practical merits of the various alternatives in training programs.

There is concern as to whether we can recruit the type of student who might best serve the needs of two-year colleges. There is question as to whether any new training programs can be successful unless they attract good people. Also, successful two-year colleges have hired effective teachers of diverse backgrounds, suggesting that the kind of teacher training is less important than the quality of the individuals who enter the field.

Science departments should welcome the interest and help from colleges of education in attracting good people and in training them soundly for college teaching assignments in chemistry. The competition between teaching and research must be put in perspective. The fact is that research constitutes a teaching as-

signment for the research professor.

Also, the idea of joint appointments in education and in chemistry warrants encouraging, especially as it relates to the control of internships giving practical classroom experience to prospective teachers. Field experience in two-year college situations seems especially desirable in the training of candidate teachers. Also, knowledge about opportunities in the two-year college field must be disseminated more widely among chemistry faculty members and students at universities.

## THE ROLE OF THE GRADUATE SCHOOL IN THE EDUCATION AND TRAINING OF CHEMISTRY TEACHERS FOR TWO-YEAR COLLEGES

WENDELL H. SLABAUGH, Oregon State University
Corvallis, Oregon

### RECOGNITION OF SPECIAL DEGREE PROGRAMS

Two-year colleges have reached an unbelievable level of diversity, which apparently exceeds in breadth the wide range of variations in four-year institutions of higher education. In an effort specifically aimed at providing college teachers for the full range of assignments, Oregon State University has developed, along with subject matter graduate programs, a minor (administered by the Graduate School) in College and University Teaching. This minor carries a group of courses concerned with teaching methods, college curriculum, and student problems. Over 100 graduate students have elected this minor over the past 20 years. There has been some reluctance to set up another program concerned particularly with the training of two-year college teachers, since it has been felt that the requirements in this field are not radically different from those met by teachers in any college situation.

At present, Oregon State University is eager to help in providing well-qualified teachers for two-year college positions and will seriously consider any new programs which are recommended by this conference.

The Oregon State University Quarterly Journal, "On Improving College Teaching" deserves wider circulation among other universities which are considering new programs for the training of college teachers. Universities now have the major responsibility for deciding what kind of training should be given. Whether separate programs for such teachers are necessary or desirable may be questioned but the development of a broader spectrum of teacher training programs might thus provide more teachers who can qualify for the most varied needs of two-year colleges.

The concensus held that for many assignments in two-year colleges, the training requirements do not differ from those of teachers in four-year colleges and universities but that the conventional programs really do not fit the needs of *all* two-year college teachers.

# CONFERENCE SUMMARY AND RECOMMENDATIONS

JAMES THORNTON, San Jose State College
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In listening to the deliberations of a conference such as this, one has the feeling that he has been here before, that the same problems have been discussed and the same deficiencies noted in almost any discipline one can name. As a person with a junior college, community college, or two-year college background, I have a feeling of being in friendly surroundings since there are many kindred spirits here, persons sympathetic with the problems that affect every phase of the educational community.

The general plan will be to recite two or three items that seem to be *missing* from the deliberations, papers presented, critiques, and discussion. There will be an attempt to summarize some of the concern about the role of the two-year college and its teachers; to review some of the problems of increasing the supply of properly trained teachers; to discuss, in the context of papers presented, some of the ideas of training after employment; and finally to give some recommendations that stem from the two days of discussion. There will be no effort to summerize in detail each of the ten papers since these will be abstracted and presented in written form.

One of the *missing* items is that of the limited nature of the junior college instructional program. The teacher, by and large, is responsible only for the first two years of instruction (the freshman and the sophomore level). It takes a rather special person to return year after year to the two-year college and engage in the same level of teaching. When recruiting a teacher, this must be recognized and explained.

A second missing item is the need to recruit the teacher in the junior college at a very early age. Returning to the limited nature of instruction, it is known that 84% of the staff are involved in instruction at the freshman level (this same percentage would be applicable to student effort) while the 16% remaining are in sophomore level courses. The important aspect of retaining interest is obvious. We should work on doubling the number of students that retain interest through to the second year. The teacher should think of himself as a salesman or even an actor in putting across the enthusiasm of his product.

The third item missing is one that indicates that there is very little cross-discipline teaching. An example will illustrate the point. A group of scientists were engaged in a learning experiment involving animals; the role that the chemical structure of brain tissue plays in the learning process. The problem involved the full cooperation of a neurologist, physiologist, psychologist, physicist, and a biologist, all working as a team. Team teaching, well known at the elementary and secondary school levels, is not often found in chemistry teaching.

### Universities' Obligations to Two-Year Colleges

Well recognized, but perhaps not appreciated by the conferees, is the multi-role played by the two-year college and its impact on the four-year college. Statistics show that in some states as high as 80% of the lower division students are in the two-year college. This has placed the university and many four-year colleges in a new and unique role. Teacher training in these institutions will be in need of observation. The university must now play a more critical role in the preparation of the two-year college teacher. The local control of the two-year college, rather than the more frequently found state or even national control of universities, suggests hazards as well as opportunities. There is a magnified concern in the two-year college for quality of instruction since the research time is not a diluent of the staff operation. Both factors need stress: the *subject matter* must be competently taught and the *student* must be competently taught. It is reasonable in the preparation of the teacher that some post masters work should be incorporated into the training of the two-year college teacher. This may be through special seminars.

### Increasing the Supply of Two-Year College Faculty

A variety of points come to mind in increasing

the supply. (a) There are still competing demands for potential two-year college teachers — university and industry are competing for the talented student; (b) the comparative salary levels in the junior college are favorable in some but not all states; (c) the increase in the numbers of colleges and the number of students will continue to influence the educational process; (d) there are persons inadequately trained now in the two-year colleges (these people must either be retrained or replaced); (e) additional teachers should be brought in to reduce teaching loads, and allow the present teachers to upgrade themselves and spend additional time in preparation of their class work; (f) the obligation of the university to recognize teacher training for two-year college and not discourage the able student who desires this kind of work by insisting upon a research-only stream of postgraduate education.

### Some Training in Teaching Must Accompany Training in the Subject Area

There is a near unanimity in the two-year college administration that, if a teacher is to spend his life in the environment of teaching and close consultation with students, it is only right that he include courses in higher education, teaching methods, etc., in his curriculum. The preparation for the two-year college is expected to involve something a little beyond the usual subject — master's degree. A recognized three-year master's degree (suggested by Oliver Carmichael) permits a combination of course work, research and, finally, student teaching (or internship). At a point in this preparation, the student can move in one of several directions and if he has real interest in the pursuit of research, he can be encouraged to proceed to the Ph.D. degree.

### New Degree Programs May Increase Both Numbers and Quality of Two-Year College Faculty

In the conference a myriad of degree programs has been discussed. The predominant fact seems to be that we should not dodge the issue by changing names. Thus, the several doctorates, other than the Ph.D., will not provide the manpower needed and probably will not do more than create more problems than they solve. The most serious perhaps is the lowering of the standards of recognized degrees. We should at all times, though, leave the door open for the teacher to continue his education, to strive for new heights—perhaps rewarded by new degrees. As a new degree, the Candidacy Certificate mentioned several times, seems to have merit as it recognizes a state of accomplishment, and that there is a higher order of accomplishment.

### Good Teaching Can Be Rewarding

The positive attributes of the teaching at the two-year college level should be stressed and even advertised. The work is satisfying and gratifying. A teacher doing a good job will be happy in his work. The dissatisfied ones are usually the underprepared or improperly prepared teachers. A teacher is likely to be more secure in his work if he is prepared through proper seminars in class conduct. This kind of preparation is also likely to come through the internship approach. The proper use of new media will give new insights on teaching and produce enthusiasm which may not have existed before.

### Self-Improvement by the Teacher Must Be Rewarded

A strong recommendation to any administration is to find every possible route in reducing teaching loads. Such a reduction must assume that time freed will be used in the best possible fashion in improvement of professional qualifications. This might be in: independent research, updating through study and reading, or scholarly writing. The well known routes for teacher preparation such as sabbaticals, exchanges, summer session courses, extension and night programs, ACS short courses, Saturday classes, and short-term institutes should be used to advantage.

At the expense of redundancy, the point is again made that the routes must be kept open for self improvement. We must constantly remind ourselves that the time for learning is now. No man's education is ever completed.

## APPENDIX A

### CONFERENCE PARTICIPANTS

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*Observer*

Professor Martin D. Brown, CUEBS Representative, Fullerton Junior College, Fullerton, California 92632

## APPENDIX B

### Questionnaire to Chemistry Faculty

To Chemistry Teachers in Two-Year Colleges

June 2, 1967

Dear Colleagues,

As part of its NSF-supported mission for improving instruction in college-level chemistry, the Advisory Council on College Chemistry is now working on materials and programs especially of use to two-year colleges. In order to guide this work, we have urgent need for some facts which can be supplied only by the *active teachers of chemistry in two-year colleges.** To this end we earnestly solicit your *prompt response* to the attached questionnaire, using the attached, stamped envelope for return to us.

As a two-year college science teacher you may also have received copies of a more general questionnaire which was recently circulated on a sampling basis by the AAAS. Answers to both questionnaires will be needed in order to implement forward plans which should benefit your college and you. The results of these questionnaires also will be of immediate use to the education office of the American Chemical Society and to the Chemical Education Division's Two-year College Conferences.

All persons returning this completed form will be added to our mailing list if they are not already receiving $AC_3$ publications. Our recent Reports on Modern Teaching Aids and on Problems in Two-year College Chemistry will be of special interest to you.

We look forward to larger participation by two-year college teachers in the activities of $AC_3$. We will be calling on some of you individually for opinions about our programs, but also will welcome voluntary comments on a continuing basis from you. Your assistance is appreciated.

*Yours sincerely,*

ROBERT C. BRASTED
*Committee for Teacher Development*
University of Minnesota
Minneapolis, Minnesota 55455

W. T. MOONEY, JR.
*Committee for Chemistry in the Two-year Colleges*
El Camino College
Via Torrance, California 90506

* An earlier questionnaire was recently sent to administrators of two-year college chemistry professors. The present questionnaire also should be completed by administrators who have some teaching duties in chemistry.

## TEACHING STAFF IN TWO-YEAR COLLEGES (1966-67)

PLEASE TYPE OR PRINT

**(I)** Name _____
(Your last name first)

(A) Home Address _____

_____

_____
(Zip)

**(II)** Institution _____
(Your present employer)

(A) Address _____

_____

_____
(Zip)

**(III)** Year of birth _____

**(IV)** Your years of service with this institution _____

**(V)** Educational Profile

(A) Degrees

| Type of Degree | Year Received (a) | Major (b) | Institution(s) (c) |
|---|---|---|---|
| (1) AB | | | |
| (2) BS | | | |
| (3) MA | | | |
| (4) MS | | | |
| (5) PhD | | | |
| (6) EdD | | | |
| (7) | | | |
| (8) | | | |

(B) Supplementary Education — Work taken since baccalaureate degree which was not part of a complete degree program. (Do not include courses in NSF-supported institutes)

| Field of Study | Number of Semester Hours (a) | Year of Enrollment (b) | Institution(s) (c) |
|---|---|---|---|
| (1) Chemistry | | | |
| (2) Bio-Science | | | |
| (3) Geo-Science | | | |
| (4) Math | | | |
| (5) Physics | | | |
| (6) Engineering | | | |
| (7) Education | | | |
| (8) | | | |
| (9) | | | |

(C) Supplementary Education — National Science Foundation or other Special Programs

| Year | Type of Program and Sponsor (i.e., NSF Summer Institute, Research Grant, NASA In-Service Institute, etc.) (a) | Level of Program (i.e., HS Teachers, College Teachers, etc. (b) | Institution(s) (c) |
|---|---|---|---|
| (1) 1958 | | | |
| (2) 1959 | | | |
| (3) 1960 | | | |
| (4) 1961 | | | |
| (5) 1962 | | | |
| (6) 1963 | | | |
| (7) 1964 | | | |
| (8) 1965 | | | |
| (9) 1966 | | | |
| (10) 1967 | | | |

(D) Preparation for College Teaching

(1) Did you ever serve as a graduate (a)_____, or undergraduate (b)_____, teaching assistant in a college or university chemistry department? (Check appropriate blank if **yes**)

(2) If yes, in which college(s)?
(a)_____ No. of semesters? (b)_____
(c)_____ No. of semesters? (d)_____
(e)_____ No. of semesters? (f)_____

(3) Describe nature of your duties.
(a) Lecture? _____
(b) Demonstrations? _____
(c) Recitation section? _____
(d) Laboratory? _____
(e) Stockroom? _____
(f) Grading papers? _____
(g) Other. Specify _____

(4) Did you ever complete a college or university course (or seminar) concerned chiefly with the teaching of college chemistry?
(a) Yes_____ (b) No_____
(c) Where? _____

(5) Do you now feel that your teaching would be improved by more methods courses, i.e., courses taught by an Education Department?
(a) Yes_____ No_____

## (E) Two-year College Training

(1) Did you ever attend a two-year college as a student? (a) Yes_____ (b) No_____
If yes, (c) Which college? _____
(d) Number of semester hours?_____

(2) Have you ever completed a college course concerned with junior college or community college teaching? (a) Yes_____ No_____
If yes, (c) Which year? _____
(d) Was this taken to meet a requirement for holding a position in a junior college? (a) Yes_____ (b) No_____

(3) Prior to teaching in a junior college did you have a course in practice teaching?
(a) Yes_____ (b) No_____

(4) If yes, was this at junior college level?
(a) Yes_____ (b) No_____

## (F) Educational Opportunities

(1) What is the nearest PhD/MS granting institution? _____

(2) Its distance from your home in miles?_____

(3) Nearest graduate institution without PhD degree? _____

(4) Its distance from your home in miles?_____

(5) What is the nearest university (or four-year college) offering night school or academic year in-service training for college teachers?_____

(6) Its distance from your home?_____

(7) Do the above schools offer courses of benefit to your teaching which your situation permits you to attend? (a) Yes_____ (b) No_____

(8) What is the nearest institution offering programs which best meet your present need? Specify name _____

(9) Distance in miles from your home?_____

## (VI) Previous Professional Experience

In column (a) indicate the total number of years experience in each defined category **prior** to accepting your present position. In column (b) check the line which best describes your status in the year **preceding** acceptance of your present job.

| (A) Teaching positions in chemistry as defined below | Years Experience (a) | Prior Job (✓) (b) |
|---|---|---|
| (1) Faculty member in four-year college or university (not a teaching assistantship or research appointment) | | |
| (2) Another two-year college teaching position | | |
| (3) A senior high school teaching position | | |
| (4) Other teaching position. Specify | | |

(B) Teaching positions in fields other than chemistry. Specify.
(1) Subject area (e.g., physics)
(2) Type of institution (e.g., university)

(C) Other academic activity
(1) Teaching assistantship in chemistry
(2) Teaching assistantship in education
(3) Research fellowship in chemistry
(4) Research fellowship in education
(5) Administration. Specify type of institution
(6) Other. Specify

(D) Military service. Specify

(E) Industry, (G) Government, (H) Foundadation (underline which)
(1) Research
(2) Administration of research
(3) Other. Specify

(F) Retired from any of above activities? Specify

## (VII) Present Position

| (A) Course Assignments (check in first column the subjects you taught this year; in the second column the subjects you taught in years 1960-1966 at your present institution; in the third column check subjects taught in other institutions in 1960-66 period.) | 1966-67 This Instit. (a) | 1960-66 This Instit. (b) | 1960-66 Other Instit. (c) |
|---|---|---|---|
| (1) General chemistry (may include qualitative analysis.) The course suitable for science and engineering majors. | | | |
| (2) Chemistry for non-science majors (college level.) | | | |
| (3) Beginning chemistry (preparatory course for general chemistry.) | | | |
| (4) Organic chemistry. | | | |
| (5) Analytical chemistry (quantitative analysis and instrumental methods.) | | | |
| (6) Physical chemistry. | | | |

(7) Chemical technology or chemical engineering technology (e.g., for training of technicians.

(8) Chemistry for nurses and/or paramedical students.

(9) Special problems (i.e., research for chem. majors.)

(10) Physical science, General science, or interdisciplinary course for non-science majors including chemistry.)

(11) Physics.

(12) Math

(13) Biological sciences.

(14) Geological science.

(15) Engineering courses.

(16) Other. Specify

(17) Other. Specify

(18) Other. Specify

(B) Assigned work load in academic year 1966-67 (use first two columns if on semester system; all three columns if on quarter system)

| | Number of assigned weekly contact hours | | |
|---|---|---|---|
| | Fall sem. Fall qtr. (a) | Spring sem. Winter qtr. (b) | Spring qtr. (c) |
| (1) Lecture classes | | | |
| (2) Laboratories | | | |
| (3) Recitation or tutorial classes | | | |
| (4) Student counselling | | | |
| (5) Administrative allowance | | | |
| (6) Other. Specify | | | |
| (7) Other. Specify | | | |

(C) Unassigned hours estimated average number of hours spent **weekly** on the listed activities as required to handle your job)

| | Number of hours | | |
|---|---|---|---|
| | Fall sem. Fall qtr. (a) | Spring sem. Winter qtr. (b) | Spring qtr. (c) |
| (1) Preparing examinations and supplements for classes | | | |
| (2) Grading examinations, reports, homework, etc. | | | |
| (3) Preparing reagents and equipment for laboratory use or lecture demonstrations | | | |
| (4) College and faculty committees | | | |
| (5) Community service assignments on behalf of college | | | |
| (6) Other. Specify | | | |
| (7) Other. Specify | | | |

**(VIII)** Opinions

What are your views regarding the kinds of courses which should be developed to meet your needs for keeping current in chemistry and for improving your teaching effectiveness in your courses (i.e., do you favor more advanced courses in your professional field, work with visual aids for teaching present courses, etc.).

Signature _____

Date _____